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THE GEOGRAPHICAL RESULTS OF THE TIBET MISSION.*

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Though I shall tell to-night of a journey to the "Forbidden City," there is, I fear, little, strictly speaking, new that I shall have to say. My companions and myself were, indeed, the first Europeans to enter Lhasa for many years. Still, we cannot claim credit for having been the first of all, and all I can do is to corroborate and emphasize the work of former travellers, and especially of those hardy Indian explorers A-K, Sarat Chandra Das, and others, who had made such careful surveys and interesting notes that some at least of our obstacles were removed.

Such corroboration is, however, very necessary, for an impression had of recent years grown up in Europe that Tibet was a wretched, poor, inhospitable country; and this is not what those few travellers, European and Indian, who had been to Lhasa before had described, nor is it actually the case. The northern part of Tibet, which is all that recent European travellers have seen, is indeed barren, uncultivated, and worthless, and this forms quite two-thirds of the whole. But Tibet is a large country—as large as the provinces of Bombay, Madras, and the Punjab put together, and there is a third part still remaining which is remarkably well cultivated, which is dotted over with thriving villages and the well-built and comfortable residences of the Tibet gentry. Taking it as a whole, then, and excluding the worthless desert portion, Tibet is probably fully as rich as Kashmir or Nepal. The valleys in which Lhasa, Gyantse, and Shigatse are situated, and the valley of the Brahmaputra, are neither barren plateaux nor yet narrow V-shaped gorges. They are flat valleys from 4 or 5 to as much as 10

* Read at the Royal Geographical Society, February 13, 1905. Map, p. 588.

miles broad, covered with good soil, well irrigated, and richly cultivated. This is the most important geographical fact which, though mentioned casually by former travellers, we were able to re-establish and confirm.

And with this fact clearly impressed upon your minds, let me now ask you to follow in the footsteps of the Tibet Mission in its journey from India to Lhasa. We unfortunately had to take our bodies there, and for the human body Tibet and Sikkim, through which we had to pass on the way into Tibet, are at certain seasons anything but attractive. You, however, need go there in mind only, and for the mind I do not know, in the whole realm of nature, any greater glories than Sikkim and Tibet afford. At the very outset of our travels was the sight which in all the world I consider the supreme—the view of Kinchenjunga from Darjiling, described by many travellers before, but by none better than by Mr. Douglas Freshfield in his recent book on this region. We had then to pass through as superb tropical forests as are anywhere to be met with, and, emerging on to the high Tibetan tableland, it was our good fortune to live for a month in full view of the magnificent panorama of 150 miles of the highest peaks in the Himalayas, with the loftiest mountain in the world as the culminating object. Lastly, we had ever before us in the dim mysterious distance the Sacred City, of which so little was known, and entrance to which was barred by every obstacle which man and nature could raise; and while my military companions had constantly to think of how best to overcome the resistance we might encounter, we of the political service had continually with us the earnest desire and the ambition to lessen by all our powers of reasoning and persuasion the military resistance, and above all so to impress the people who were now first making our acquaintance, that on our departure their disposition towards us should be one of friendliness rather than hostility, and that they should no longer look upon us as people to be roughly and rigidly excluded, but, on the contrary, respected and welcomed.

What more inspiring task could any men be entrusted with? And while this is not the place to speak of the military and political work of the mission, I may at least say that our objects *were* attained, and I may express my firm conviction that from this time onwards all European travellers will be the gainers for what the British Mission to Lhasa did in 1904. One only evil geographical result I foresee. This Society will have one less destination for the adventurous explorers of Great Britain, and the Sven Hedins of the future, like a fast-expiring race, will be driven back and back till they finally vanish from the Earth amid the Arctic snows. But for this misfortune not we only are to blame, but also and chiefly one of your own Gold Medallists, the great Viceroy of India, to whose initiative the whole enterprise was due, and without whose constant support it could scarcely have been brought to a conclusion so disastrous for future explorers.

Our start from Darjiling in June, 1903, was miserable enough. The monsoon was just bursting, the rain was coming down in cataracts, and all was shrouded in the densest mist. Few knew of the enterprise upon which I was embarking, but a little knot of strangers who had assembled in the porch of the hotel had got an inkling, and shouted "Good luck" as I rode off, covered with waterproofs, into the mist to join my companions, Mr. White and Captain O'Connor, in Sikkim. And detestable though the rain was, there was still a large surplus of joy in riding through those wonderful Sikkim forests, day after day seeing fresh marvels of forest growth or flowery beauty. The mountain-sides were everywhere a wealth of tropical vegetation, rich and luxuriant. And here under the shade of the mighty giants of the forest grew the stately tree-ferns, often 40 or 50 feet in height, with fronds 10 or 12 feet long. All were in bright fresh foliage, and besides ferns of every graceful form and of the subtlest delicacy of tracery were variegated coloured plants, like calladiums, and closely connecting all together and festooned from tree to tree were creepers of every size, from the great elephant creeper whose leaves resembled elephants' ears, to light trailing vine-like tendrils lightly strung from bough to bough; while here and there, as some bright surprise, the eye would light upon the most perfect orchid, or other flowery marvel, which brought one to a halt in an ecstasy of enjoyment. Nor should I omit to mention the brilliant butterflies glinting past on every side. Seventeen different kinds did I count in the space of 200 yards in the Teesta valley; and in few other places in the world are to be found such a variety of rare butterflies, so many different orchids, and such a wealth of trees and flowers as in Sikkim. There are, I believe, over six hundred different orchids alone to be found here, and over sixty separate kinds of rhododendron.

Fain would I dwell longer on the attractions of this wonderful country, but it is with Tibet itself that we are chiefly concerned to-night, and thither I must without delay transport you. Just cross one pass, and all is changed. On the far side of the Kongra-lama pass not a tree is to be seen. If in some secluded nook a plant a foot high is met with, it is a curiosity. In place of the deep-cut valleys of Sikkim there are great plains 10 or 12 miles wide. The sky is cloudless, and the view extended over many and many a mile. Here at Khamba Jong Mr. White had laid out a camp, and here we spent many delightful months, doing our best to bring to reason a people nearly as obstinate as ourselves, and between whiles making roving expeditions to distant valleys, geological investigations with Mr. Hayden of the Geological Survey, botanical trips with Dr. Prain of the Botanical Gardens in Calcutta, natural history expeditions with Captain Walton, I.M.S.; every day and every hour enjoying the charming summer climate, and, above all, the unrivalled panorama of the mighty Himalayas at the very culminating point of their grandeur, where all

the loftiest peaks in the world were majestically arrayed before us. Captain Ryder, known to you for his journey in China, surveyed and measured all this wonderful region, and will, I trust, before long give you full particulars of his surveys. But who will ever be able to adequately describe the fascination of that glorious range of mountains? From sunrise to sunset the days were a continual delight. As I looked out of my tent in the early morning, while all below was still wrapped in a steely grey, far away in the distance the first streaks of dawn would be just gilding the snowy summits of Mount Everest, poised high in heaven as the spotless pinnacle of the world. By degrees the whole great snowy range would be illuminated and shine out in dazzling, unsullied whiteness. Then through all the day it would be bathed in ever-varying hues of blue and purple till the setting sun clothed all in a final intensity of glory, and left one hungering for daylight to appear again.

And all was rendered doubly interesting from the history of its geological past, which Mr. Hayden was able to describe to me. He was indeed enraptured with the district from the geological standpoint, and a bed of fossil oysters he discovered there had more fascination for him than Lhasa itself. He was able, from the oysters, to accurately determine the age of the hills in this part of Tibet. According to him they were "recent," that is to say, not more than two or three million years old, and the main axis of the Himalayas was thoroughly modern, perhaps not more than a few hundreds of thousands of years old. In what to geologists are really ancient times Tibet was below a sea which washed around the base of the Himalayas—a mighty granite ridge which is constantly being protruded upward from the interior of the earth, and ever being worn away by the snowfall on its summit. Never have I been able to see Nature at work on such a mighty scale as here, and when the scientific results of Mr. Hayden's work in this region have been thoroughly investigated, I feel sure they will prove of the highest interest and value.

The mission remained at Khamba Jong from July 7 to December 6, but long before the latter date we had discovered that our political objects would never be obtained until we advanced further into the country. A move on to Gyantse was accordingly ordered, and as a considerable body of troops, under the command of General Macdonald, was to escort the mission, the line of advance was changed on to the Chumbi route.

Winter was now on us, and the difficulties which General Macdonald and his troops had to contend with can hardly be realized in England. But not even the rigours of a Tibetan winter were able to stop the advance of the little force of British and Indian troops.

Early in December we crossed the Jelap la and descended into the Chumbi valley. At Yatung, the trade mart established under the old

THE BAMTSO LAKE AND BHUTAN RANGE.

MOUNT EVEREST FROM KHAMBAJONG.

convention, a wall had some years ago been erected to exclude our trade, and beyond this our traders had so far never been allowed to pass. As we debouched on a bright frosty morning from the pine forest in which we had encamped for the night, we saw this wall built right across the road and high up the mountain-side on either hand. Whether we should have to fight our way through, or whether the Tibetan general would respond to the arguments I had used the previous day and gracefully allow us through, had yet to be proved, and General Macdonald used every military precaution. But, to our relief, we saw the great door in the tower standing open, and we were soon passing peaceably through the gate of Tibet, never, I hope, to be closed against us again.

We then emerged on to the main Chumbi valley, which, though not wide and open like the valleys we afterwards saw in Tibet Proper, is decidedly less steep and narrow than the Sikkim valley. Both in the valley-bottom and on the hillsides there was room enough for comfortable villages and cultivated fields. The people were very well-to-do, and, what was more satisfactory from our point of view, decidedly well disposed. They soon showed themselves to be keen traders, and must have made large fortunes out of us during last year. They are not true Tibetans, but are called Tomos. Nor is their valley, which is on the Indian side of the watershed, considered a part of Tibet Proper, which is looked upon as extending only as far as the mouths of steep gorges we a few days later passed through in the upper part of the valley. The rainfall is only about half that of Darjiling, and the climate in general much superior.

The mission remained three weeks in Lower Chumbi, while military preparations for a further advance were being made; and then in the very depth of winter, on January 8, we crossed the Tang-la, 15,200 feet high, on to the Tibetan plateau again. Never shall I forget that day. Reveillé sounded at the first streak of dawn, and as I looked out of my tent the very spirit of Frost seemed to have settled on the scene. The stars were shooting out sharp clean rays from the clear steely sky. Behind the great rugged peak of Chumalhari the first beams of dawn were showing out, but with no force yet to cheer or warm, and only sufficient light to make the cold more apparent. Buckets of water were, of course, frozen solid. The remains of last night's dinner were a hard solid mass. The poor Sikhs were just crawling out of their tents, so shrivelled with the cold it looked as though, if they shrivelled much more, there would be nothing left of them. The thermometer stood at 18° below zero, or just 50° of frost, and though this is not considered much in Canada and Siberia, and I dare say those who have just returned from the Antarctic would consider it pleasantly warm, I should remind you that 50° of frost at a height of 15,000 feet above sea-level is a very different thing from 50° of frost on the sea-level. At 15,000 feet

where the effort of breathing is a continual drain upon one's strength, the mere weight of the heavy clothes one has to wear in cold weather is a sufficient strain in itself. Any additional effort exhausts one immediately. And if it tries us Europeans, who are more or less inured to cold, how much more distressing must it be to the natives of India! and that they were able to march 15 miles across the pass that day, and spend the rest of the winter, as they had to, immediately on the other side, at a height of but little under 15,000 feet, is, I think, a striking testimony to their powers of endurance and the high spirit which prevails among them. Colonel Hogge and the 23rd Pioneers most willingly faced this ordeal, and by this act of endurance proved once and for all to the Tibetans that their country was no longer inaccessible to us, even in the depth of winter.

Here at Tuna more fruitless parley with the Tibetans ensued. They paid one or two visits to me, and once I rode over with Captains O'Connor and Sawyer to see them amid their own surroundings, to gauge their capacity, and to estimate the strength and direction of the various influences at work among them. It became sufficiently evident to us that the real control of affairs was in the hands of the Lhasa lamas, three of whom, one from each of the three great monasteries at Lhasa, were present on the occasion. The four generals whom we then met were amiable and polite enough. They repeated by rote the formula, "Go back to the frontier." But the impetus to obstruct came from the three lamas, who, with scowls on their faces, remained seated on the ground, showing not the slightest signs of civility or ordinary politeness, and instigating the generals to detain us in the Tibetan camp till we would name a definite date for withdrawal. When I think of their rabid fanatical obstruction on that occasion, and compare it with the almost cordial reception we subsequently had in all the great monasteries and in the most sacred shrines before we left Lhasa, I cannot help feeling that we went a long way towards breaking down that barrier of exclusion which, set up by the lamas for their own selfish ends, has kept away from us a people who, when left to themselves, showed every inclination to be on friendly terms with us and indulge their natural instinct for trading.

But parleying with the Tibetans occupied only an insignificant part of my time at Tuna, and I had ample leisure to enjoy the magnificent natural scenery around us. Immediately before us was an almost level and perfectly smooth gravel plain, which gave a sense of space and freedom, and on the far side of the plain, 10 or 12 miles distant, rose the superb range of mountains which forms the main axis of the Himalayas and the boundary between Tibet and Bhutan. They were an unceasing joy to me, and the sight of them alone was ample reward for all the hardships we had to endure. The sun would strike our tents at about seven in the morning. The sky would generally then

be cloudless save for a long soft wisp of gauze-like haze, and perhaps a few delicate streaks of pink or golden cloud poised motionless on the horizon. And the great snowy mountains, in the early morning when I used to go out and watch them, instead of being sharp, clear, and cold, would be veiled in that blue, hazy, dreamy indistinctness which makes the view of Kinchenjunga from Darjiling so marvellously beautiful, and the hard stern mountains as ethereal as fairyland. The bare brown of the base of the mountains was toned down into exquisite shades of purple and pink, while the white of the snowy summits shaded softly into the cerulean of the sky above. On the plain plump little larks and finches would be scurrying about in search of food. Now and then a little vole would be seen basking in the sun at the mouth of his hole. And over all there reigned a sense of peace and quiet which made it hard to believe that only 10 miles off five of the highest lamas in Tibet were solemnly cursing us and publishing to the people round threats of attack upon our camp.

Nor was every day, nor the whole of each day, of this same peaceful nature. Almost invariably at ten or eleven a terrific wind would arise and blow with fury for the rest of the day. Mighty masses of cloud would come sweeping up from the direction of India. Snow would sometimes fall, and then for two or three days together we would be the sport of a terrific blizzard. The mountains would be hidden, and nothing would be visible but dull masses of fiercely driven snow, as fine and dry as dust, and penetrating everywhere. For days together the thermometer would not rise above 15° even in the middle of the day. Our camp would be the very picture of desolation. It seemed impossible that the poor sentries at night would ever be able to stand against the howling storm and the penetrating snow, or that our soldiers would ever be able to resist an attack from the Tibetans under such terrific circumstances.

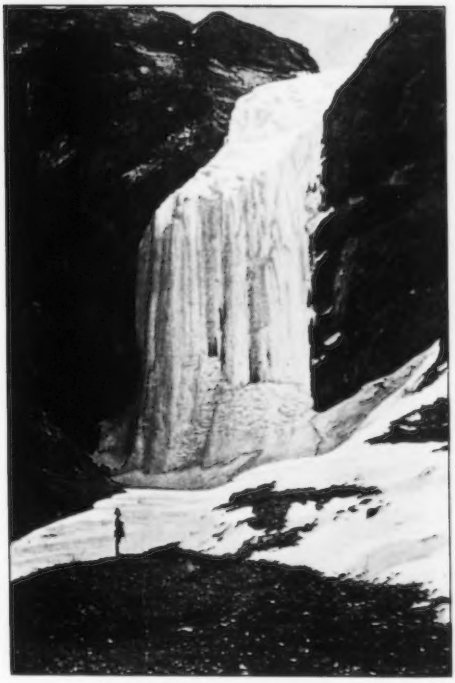
Then one morning we would find the snow-clouds had passed away from over us, and see the great peak Chumalhari emerging calm, strong, and irresistible from out of the mass of cloud still tossing wildly round its base. Below all seemed chaos. It was difficult to stand against the driving wind; the dust and the powdery snow were still battling furiously around one and around the base of the mountain, and the birds were driven hither and thither. But towering above all the tumult below, serene and majestic, and looking prouder, loftier, and purer than ever, rose the great peak reverenced even by the unimaginative Tibetans; and above it lay the calm blue sky, illimitable in its restfulness and light—a sky of bright and liquid azure, through which one seemed able to pierce right into heaven itself.

Throughout January, February, and March the bitter winds continued, often accompanied by snow in blinding blizzards, through which the convoys and their escort had to force their way with perhaps

even greater sufferings than fell to us. But gradually, as week by week went by, the temperature rose. The military preparations in rear were completed by General Macdonald, and early in April we marched down to Gyantse. Of the military incidents on the way I will say nothing. It was the deepest disappointment to me that fighting should have been necessitated, and the Tibetan generals were as little anxious for it as I was, but they had impossible orders from Lhasa—orders not to fight, not to negotiate, and not to let us proceed. Unless, therefore, we were prepared to abandon the whole object of the mission, fighting was inevitable.

Arrived at Gyantse on April 11, we found a flat open valley 5 or 6 miles wide, dotted all over with flourishing hamlets and intersected by numerous water-channels. Round each hamlet, along the water-channels, and by the bed of the river were willow and poplar trees just showing signs of bursting into foliage. The banks were covered with masses of iris plants, which later on were to flower out into sheets of purple. The piercing cold of the Tuna uplands was left behind. There was only a slight touch of frost at night, while the days were beautifully fine and bright; and we were looking forward to a restful summer of peaceful negotiation, when suddenly ominous clouds began to collect around us, and early on the morning of May 5 we were awoke by wild shouts and firing, and, looking out of our tents, we saw Tibetans firing into us through a wall only 10 yards off. How Major Murray and his Gurkhas warded off the attack; how Colonel Brander defended the post for nearly two months against the Tibetans, who had now invested us; and how General Macdonald eventually returned with a relieving force, drove back the Tibetans, and captured the jong, has been told elsewhere. Geographically, the important point is that the refusal of the Tibetans to negotiate at Gyantse necessitated our advance to Lhasa. On July 14 we set out, much impeded by heavy rain, and soon set aside the delusion that Tibet is a rainless country. Well on till September we had frequent rain, and the size of the rivers and side streams was quite sufficient evidence that this part of Tibet receives—probably up the Brahmaputra valley—a quite considerable rainfall, say between 20 and 30 inches, at a rough guess.

We crossed the easy Karo-la pass, about 16,000 feet, where Colonel Brander had fought his gallant little action early in May, and the next day debouched on to the most lovely lake I have ever seen—the Yamdok Tso. In shape it was like a rough ring, surrounding what is practically an island; and in colour it varied to every shade of violet and turquoise blue and green. At times it would be the blue of heaven, reflecting the intense Tibetan sky. Then, as some cloud passed over it, or as, marching along, we beheld it at some different angle, it would flash back rays of the deep greeny blue of a turquoise. Anon it would show out in various shades of richest



FROZEN WATERFALL AT DOTHA.

THE YAMDOK TSO.

violet. Often, when overhead all was black with heavy rain-clouds, we would see a streak of brilliant light and colour flashing from the far horizon of the lake; while beyond it and beyond the bordering mountains, each receding range of which was of one more beautiful shade of purple than the last, rose once more the mighty axial range of the Himalayas, at that great distance not harsh in their whitey coldness, but softly tinted with a delicate blue, and shading away into the exquisite azure of the sky. What caused the marvellous colouring of this lake, which even the Tibetans call the turquoise lake, we could none of us say. Perhaps it was its depth, perhaps it was its saline character, or some chemical component of its water. But whatever the main cause, one cause at least must have been the intensity of clearness in the liquid Tibetan sky, so deep and so translucent that even the sky of Greece and Italy would look pale and thick beside it.

For three days we marched along the shores of this beautiful lake, and then we ascended our last pass and looked down on to the Brahmaputra river, and almost upon Lhasa itself. But the sacred city was still left hid. Masses of mountains in range after range were all we could see in that direction, and General Macdonald had still the very serious obstacle of the Brahmaputra river, now in almost its full flood, to overcome before we could reach our goal. The Brahmaputra we found to be divided into numerous channels, but we were able to cross it at a spot where it narrowed to 200 yards, though not without the loss by drowning of the one officer to whom, of all others in the force, our success in reaching Lhasa was due—Major G. H. Bretherton, the chief supply and transport officer. The river rushed in whirling vortices past a cliff, from which Captain Sheppard, R.E., suspended a wire rope to the opposite side, and upon it rigged up a flying ferry. The river valley was from 3 to 5 miles wide, and, like the Gyantse valley, richly cultivated with wheat and barley, dotted over with hamlets, monasteries, well-built and comfortable residences of the great men of the country, and with pleasant groves of poplar, walnut, and even a few peach and apricot trees. The side valleys were also well cultivated, and the hillsides, though bare of trees, were covered with grass, which should afford excellent pasturage for many more sheep and goats than we actually saw there. It was altogether a smiling prospect, and doubts as to the possibility of being able to supply our troops with the necessaries of life, for the year round if required, were at once removed.

I was now met by a variety of deputations, each one of increasing weight and importance, and each more urgent than the last in begging me not to proceed to Lhasa. The Dalai Lama himself even wrote to me, an act of unprecedented condescension on his part; and he sent his High Chamberlain to say that if we went to Lhasa, his religion would be spoilt and he would die. I had to inform him, in reply, of the

delicate and painful position in which I was placed, for if, on the one hand, I went on to Lhasa, I understood that His Holiness would die, while if I stayed where I was I would myself die, as I would undoubtedly have my head cut off if I failed to obey the orders I had received and negotiate the treaty in Lhasa itself. Reluctant as I was to cause the premature demise of the Dalai Lama, I felt I had no alternative, I informed the High Chamberlain, but to proceed to Lhasa.

Expectation was now at its height. Each corner we turned we felt sure we should see Lhasa. We hastened to the top of one rise after another in the hopes of catching the first glimpse. The advance patrols of mounted infantry, on their return, were eagerly questioned. At length, on August 2 we rounded our last corner and saw the golden roofs of the Potala of Lhasa glittering in the distance, and on the following day encamped beneath its walls.

Here in a lovely valley covered with trees, rich with cultivation, and watered by a river as broad as the Thames at Westminster, here hidden away by range after range of snowy mountains, lay the mysterious Forbidden City which no living European had seen before. To many who had supposed, because it was so secluded, it must be a kind of dreamland city, it was, I dare say, disappointing, for it was after all built by men, and not by fairies. Its streets were not paved with gold, nor were its doors of pearls. The streets were, indeed, horribly muddy, and the inhabitants less like fairies than any I have so far seen.

But the Potala, the palace of the Grand Lama, was an imposing massive structure, very solidly built of masonry, and picturesquely perched on a rocky eminence dominating the whole plain and the city at its base. Numbers of the houses in the city were, too, well built and solid, and often surrounded by shady trees. The rock-perched palace and the strange city at its base would be striking anywhere, but set in this beautiful valley, deep in the very heart of the mountains, they gathered an additional impressiveness which all who saw them recognized.

It was, however, more to the inhabitants than to their buildings that I had to devote my chief attention during my stay in Lhasa. All the leading men, both lay and ecclesiastical, here came before me, and with them I reasoned and argued and chaffed day after day and week after week. Appallingly ignorant and inconceivably unbusinesslike they were. No one man had supreme authority or full responsibility to negotiate with me. A council were supposed to be the chief executive authorities, but they could do nothing without the consent of the National Assembly, and they, without any presiding officer to control them or any sense of responsibility, simply censured instead of endorsing what the Executive Council did, while these latter were prohibited from attending meetings of the National Assembly to argue their case in person. A more hopelessly inapt organization for

PANORAMA OF LHASA FROM BA-MO-RI.

dealing with a crisis in their foreign affairs it would be difficult to imagine. But ignorant, bigoted, and apparently immovable as they were, they had their good points. They were almost invariably polite, and they were genial. The humblest little joke was enough to set them off laughing, and I do not recall separating at the close of a single interview of all the many we had at Lhasa with any feeling of ill temper. I must confess to a feeling of exasperation sometimes when I reflected that my convention had to be got through in so short a time, and no ray of daylight was for so long visible through the dreary clouds of obstruction; but these poor Tibetans do deserve credit for never having really irritated me. It was, after all, their business to make as good a bargain as they could with me, and pertinacity is a trait which need not be cavilled at. Still, it was heavy, weary work. Eight or ten of them would come together. Each one had to have his say, so that when he returned home he could boast that he had for his part spoken up to the British Commissioner. Each one I listened to patiently, and each one I answered. In this way, as every day produced a few fresh men, I worked through most of the leading men in Lhasa, while Captain O'Connor, whose trials were still greater than mine, tackled even larger numbers in his private room.

On the whole, I formed a low estimate of their mental calibre. It is impossible to regard them as much else than children. My talks with them were not only about the business in hand, but about general affairs and about religion. The Ti Rimpochi, with whom the Dalai lama left his seal in his flight for Lhasa a few days before our arrival, held the chair of divinity in the Gaden monastery, and was universally reverenced as the leading Lama in Lhasa. He was recognized as regent, and was the principal in the negotiations with me. But even he, pleasant, benevolent, genial old gentleman as he was, had really very little intellectual power, and but a small modicum of spirituality. In both he was very distinctly inferior to the ordinary Brahmin in India. He liked his little jokes, and we were always on the best of terms. But he was firmly convinced the earth was triangular. His intellectual attainments did not amount to much more than a knowledge by rote of prodigious quantities of verses from the sacred books. Discussion with him upon the why or the wherefore of things ended in bald quotations from the scriptures, and his religion chiefly consisted in ceremonial. The general run of abbots of monasteries and leading Lamas had even less to recommend them. One monastery at Lhasa contained no less than 10,000 monks, and another had 7000. But I do not think any one saw these monks without remarking what a degraded, nasty, sensual-looking lot they were. It is altogether a mistake to suppose that in Tibet is to be found a pure and lofty form of Buddhism. Buddhism and Chinese civilization certainly have raised the rough tribes who, six or seven centuries ago, inhabited Tibet, into something very much

higher than they were before these appeared. But intellectual and spiritual life is stifled by the rigorous monastic rule. All foreign ideas and individual originality have so far been trampled down. And the result is a people of inflexible rigidity, wholly unable to adapt themselves to altering conditions, and without any intellectual force or spiritual impetus. We sought for, but did not find, the wonderful Mahatmas, who would lead us to more lofty peaks of light and wisdom than ever we had trod before. And while I would not deny that Buddhism has done much to tame and civilize a barbarous race of demon-worshippers in Tibet, I would warn those who would look to Lhasa for any kind of higher intellectual or spiritual guidance, to seek nearer home for what they need. Imbued, as the Tibetans are, with much of that impassive contentment inculcated by Buddha, they are still, to all intents and purposes, demon-worshippers. Their religion is grotesque, and is the most degraded, not the purest, form of Buddhism in existence.

Happily we were able to entirely overcome that feeling of obstruction which the heads of the Tibetan Church had so far shown to outsiders. Through Mr. Wilton's influence with the Chinese officials, and Mr. White's connection of many years' standing with the Tibetan lamas in Sikkim, and his tactful suasion, we were able to gain access to all the monasteries and temples, and, before we left Lhasa, British officers went in and out with as little concern as they would to St. Paul's. I insisted upon having the Convention signed in the Potala, and in the finest hall in it, and once the lamas saw no harm resulted, and we invariably treated them with consideration, they entirely withdrew their obstruction, and when, just before leaving Lhasa, I paid a formal visit to the great cathedral called Jo Khang, I was surprised to find them actually pressing me to come inside the railings and walk round the magnificent image of Buddha—a freedom I have never had accorded me in any temple in India.

I fear I have not sufficient time to adequately describe these monasteries and temples. Outside they were solid and massive, though hardly beautiful. Inside they were weird and quaint, and sometimes grotesque. I carried away with me an impression of immense impassive figures of Buddha for ever gazing calmly and tranquilly downwards, of walls painted with grotesque demons and dragons, of highly decorated wooden columns and roofs, of general dirt and griminess, and of innumerable bowls of butter burning night and day, as candles are burnt in Roman Catholic churches before figures of the saints.

Sooner than I could ever have expected, the Convention was signed, and we prepared for our return to India. Once business had been arranged, the Tibetans were all as happy as possible. No single person was responsible; each had had his say, and if blame had to fall on any one, it had to fall on all, and all equally. But in their heart of hearts

THE POTALA FROM BA-MO-RI.

THE LHASA COUNCIL.

they knew full well that they had got off remarkably cheaply, and they had indeed the grace to acknowledge this. On the morning of our departure the regent came down to our camp and presented images of Buddha to Mr. White and myself, as well as to General Macdonald. He thanked us for saving the monasteries and temples, and in presenting the image of Buddha to me, said, "When Buddhists look on this they put aside thoughts of strife, and think only of peace, and I hope that you, when you look at it, will think kindly of Tibet."

And certainly I left Lhasa with every kindly thought. It was a perfect autumn day; the sun was bright and warm. The valley was looking its prettiest in its autumn foliage. The entire council, with their secretaries, had come a mile down the road to offer us a farewell cup of tea and to wish us God-speed on our journey. Their last words were that they intended to keep the treaty and be friends with us in future. Our hopeless task seemed indeed to have been accomplished and good will to have been established.

And all that has happened since corroborates this impression. The council had willingly given permission for a party of officers to proceed through Shigatse up the Brahmaputra, to Gartok in Western Tibet, and then back to India by Simla. This important expedition was placed in charge of Captain Rawling, who two years ago had made a most successful journey in Western Tibet, while Captain Ryder, R.E., was in charge of the survey. These two officers, with Captain Wood, R.E., and Lieut. E. Bailey as their assistants, have accomplished their arduous undertaking. Though accompanied by only an orderly each, and no armed escort, they have travelled through a thousand miles of Tibet, and been well received everywhere. Captain Ryder has surveyed 40,000 square miles of country, including the whole course of the Brahmaputra from Shigatse to its source, the Mansorawar and adjoining lakes, and the sources of the Indus and the Sutlej, and has proved beyond doubt that no higher mountain than Mount Everest lies at the back of the Himalayas. The party suffered indeed terribly from the cold, their thermometer registering 24° below zero, but they crossed a pass 18,400 feet in height in December, and reached India in safety.

I trust, therefore, you will believe that the Tibet Mission has not been barren in geographical results, and that when you wish exploration work to be done, there are good and trusty men in India ever ready and willing to do it.

Before the paper, the CHAIRMAN (Sir THOMAS HOLDICH): I must first of all express my regret, and yours too, no doubt, that to-night, owing to illness, our President is unable to be present, for this is a notable occasion. We greet Sir Frank Younghusband, not only as a distinguished officer just returned from the successful accomplishment of a most onerous duty, but as an old friend and one of the most distinguished members of this Society. Those of us who can remember the courage and determination with which he accomplished that most notable feat, the crossing

of the ice-bound Moustag mountains between China and India, have always been assured that whenever Sir Frank Younghusband should be called on to undertake some high mission for his country or his Government, he would carry it out bravely, faithfully, and thoroughly. And I could say no more than this if I were to stand here for a week, that he has amply justified our faith in him. And now he is here to tell us the story of the unveiling of Lhasa, that city of ancient, if somewhat threadbare, mysteries beyond the Himalayas, and as we are all equally anxious to welcome him and to hear him, I will at once call on him to give us his address on "The Geographical Results of the Tibet Mission."

After the paper, the following discussion took place:—

The CHAIRMAN: There seems to be quite a considerable number of members of this Society present to-night who are more or less acquainted with the northern hinterland of India, some of whom have even traversed Tibet itself. I hope some of them will favour us with a few remarks on the paper which Sir Frank Younghusband has read to us.

General Sir THOMAS GORDON: As a veteran explorer in Western Tibet and Turkestan of over thirty years ago, I wish to offer my congratulations to the successful leader and his companions of the expedition to Lhasa. Lhasa was always a point of attraction to explorers and travellers. I aspired to go there at one time, but it could not be managed. I will relate an incident connected with this desire of mine to go there. When I returned from the "Roof of the World" in 1874, the late Lord Northbrook, then viceroy of India, invited me to Calcutta, and I there met the famous Jung Bahadur, premier and *de facto* ruler of Nepal, who had come to be invested with the high dignity of the G.C.S.I. He was, of course, much interested in Chinese affairs, and when Lord Northbrook introduced me to him, he asked me much about the expulsion of the Chinese from Eastern Turkestan, and the rise to power of that remarkable man, Yakub Beg, who had established himself there as Amir. He also asked about the doings of Russia there, and our own doings, and remarked that we were a restless but practical people. I took advantage of the opportunity to ask him whether, as Nepal had friendly relations with Lhasa, he could not help me to go there, on which he became rather disturbed and nervous in manner, and said that, though they had a representative there, they had no influence or power. "In fact," he said, "one of our representatives some time ago was badly maltreated by having his nose cut off," and looking very hard at me, he added inquiringly, "You wouldn't like to run that risk?" That finished our conversation on the subject. I again offer my congratulations to Sir Frank Younghusband and his companions on their grand success.

Mr. DOUGLAS FRESHFIELD: I shall not apologize for responding to your invitation to take part in this discussion. It is true that I have never penetrated the real Tibet; but I have stood on Pisgah heights in the debatable land of Lhonak, and looked north and eastwards over the peaks and passes that hide the crops and castles of the Tsangpo valley. And I have long had my eyes on Tibet. More than ten years ago, when one of the honorary secretaries of this Society, I instigated the Council to republish Sarat Chandra Das's narrative of his visit to Lhasa. I mention this fact to-night in order to give the credit that is due to that bold Bengalee. Chandra Das has come in lately for some natural criticism. He is not a trained surveyor. He has, no doubt, some of the defects of his qualities. But it was from his work and Major O'Connor's excellent road-book that I was able to glean the information that enabled me a year ago to give the readers of our *Journal* a sketch of the region about to be entered by the British Mission, which, if it is now open to large additions, requires very few corrections.

Before I turn to the geographical points I wish to raise, I must join General

Gordon in congratulating Sir F. Younghusband on the golden opportunity he has enjoyed and the splendid use he has made of it. We meet here to-night as the members, or the guests, of a Scientific Society. But be as scientific as we may, we cannot expel, or eradicate, the romance of travel. We have come in such unusual numbers to listen to the story of one of the great adventures of our time from the lips of its hero. What more romantic tale has ever been told in this hall than that of the Unveiling of Lhasa? And was there not heroism as great as any displayed in the more summary methods of our Elizabethan adventurers, in the endurance, the patience, the persistence, the tact, the sympathy, the humanity shown by Sir F. Younghusband and his escort in dealing with this strange people?

The March of the Two Thousand to Lhasa will live as an epoch-making event in the history of Asia. Sir F. Younghusband has made it live before our eyes to-night. We have felt half frozen in that months' long bivouac on the wind-swept heights of the Tangla; we have watched the double sunsets of Tibet, east answering to west with responsive fires, reflected in the long reaches of the Turquoise Lake; we have panted to get round that last corner and see the vast bulk of the Potala, the Vatican of Buddhism, towering over the green groves and golden roofs of Lhasa itself.

We may almost have fancied ourselves—I at least have—taking tea within a circle of saffron-robed and red-hatted lamas. Doubtless they were a dilatory, undecided, tedious, tactless folk, sadly to seek in geographical and general knowledge. But they had at least one merit; there is one point on which we can fully sympathize with these Tibetan diplomatists. They thoroughly appreciated the merits of Sir F. Younghusband. They appreciated them so well that their parting request to him was that they might be permitted to invite him, or some other Englishman, to come back from time to time to Lhasa and talk things over with them. "Dis aliter visum." I may translate, for the benefit of the ladies, "The Cabinet did not see it." There are to be no more tea-parties in the Tibetan Wonderland.

But here I approach the verge of the forbidden land of politics. I must return to geographical detail.

We geographers, and you, sir, perhaps, most of all, are deeply concerned that the unique opportunities for collecting and adding to our knowledge of the Himalaya arising from the late mission should not be lost. We have read with satisfaction of recent explorations in North-Western Tibet, and of the great success which has attended the party sent out under Captain Rawling to Gartok and Simla—of their discovery that we need not correct our text-books by inserting a new highest mountain in the world, and of their vindication of Sir R. Strachey's description of the connection of the Manasarowar lakes. But Sir F. Younghusband has told us that this was only one of three important explorations he had planned. Among the most interesting enterprises left to be accomplished on the face of the globe is the tracing of the course of the Brahmaputra where, in fabled gorges and cataracts, it cuts through the chain of the Himalaya. The party that was to solve this problem was arranged for; it was sanctioned by the lamas; Mr. Needham, in Assam, was prepared to march to meet it. At the last moment the expedition was put off by some one at Simla. We must trust that it has only been delayed; that the full and formal sanction given by the Lhasa authorities will not be wasted, but that since Lord Curzon has returned to India, we shall hear that an expedition which would have not only supreme geographical interest, but also commercial and political importance, will be carried through. There is, surely, a new and strong argument in its favour in the easy success of Captain Rawling.

Another matter of great interest to us here is to obtain the publication of the geographical results of these missions and expeditions. We recognize the military reasons for certain restrictions; but we demur to the lack of discretion that pigeonholes indiscriminately harmless facts, sometimes pigeonholes them so completely that our own officials cannot get at them when they are wanted. It may be right sometimes to lock up large-scale maps. It is wrong, and may be dangerous, to forbid their utilization under reasonable restrictions in the production of small-scale maps and the correction of atlases. For statesmen use atlases as often, if not more often, than large-scale maps.

One more point I must refer to. Chumbi has become a household word during the past few weeks. I am not going to enter here into questions of policy. I must confine myself to facts.

Chumbi is the name of a wooded valley some 20 miles long, a wedge of Tibetan territory running out on the Indian side of the Himalaya. Neither by position nor by its inhabitants, neither geographically nor ethnologically, is it Tibetan. Historically the matter is more complex. Some time early in the last century the Tibetans occupied it, along with other ground lying south of the Himalaya in the basin of the Tista, the nearest river to the west. From all the Tista territory we have expelled them. But in a convention drawn up in 1890 between Great Britain, China, and Tibet, we recognized Chumbi as Tibetan. This convention might have given Tibet a diplomatic title to Chumbi, had it ever come into operation. But it was at once repudiated, and has been steadily disregarded by the Tibetans, and our own Government, consequently, before marching to Lhasa, formally declared their intention to modify its terms. The Secretary of State for India, however, quoted this abortive convention as a ground for upsetting the terms of the treaty negotiated by Sir F. Younghusband. On other grounds it might be inexpedient to argue that Chumbi does not come within the terms of the undertaking volunteered by Lord Lansdowne to the Russian ambassador in November, 1903, not to "permanently occupy" any "Tibetan territory." But that any such pledge should have been given argues, in my judgment, an imperfect appreciation of local and historical facts.

Chumbi is no part of Tibet proper; it is the porch, the gate-house of Tibet, to which Phari is the northern and Yatung the southern door. These doors can never again be wholly closed. There is, I know, vague talk in the air of "sterilizing" Tibet—an unfortunate and unscientific phrase, for how will you sterilize that which you cannot keep hermetically sealed? Tibet faces India; the great river of Tibet flows into India; the barrier of Asia here is the northern desert, not the eastern Himalaya. That chain on the south is a wall, but on the north, to those on the top of the wall, its passes (I use Major O'Connor's phrase) lie over Wiltshire downs. Grasp these facts firmly. When they have become part of public knowledge, they may have a better chance of penetrating to the ears of Cabinet ministers and being recognized in national policy.

Sir Henry Howorth: Perhaps I may be permitted, on behalf of another class than geographers, to add very strong testimony to the extra interest of this quite unexampled journey. I speak, if I may, on behalf of those among whom I have spent many years, who have devoted the best portion of their leisure to trying to illustrate the history and the ethnography of the vast regions of which Tibet is the focus, and which stretch in all directions in a fan-like manner from the Volga to the Eastern sea. May I say just one word in addition to what you have said about the almost tragical fact that our President, who in a literary sense re-discovered Tibet for us, who published those wonderful journals of Manning and his companion which, in recent years at all events, have brought Tibet back to us in a living way, should

not have been here to-night to welcome this most wonderful addition to all our knowledge. And may I say, in addition, that one feels in this room the shade of another great geographer and historian of Central Asia, my old friend and master, Henry Yule, whose heart was in Lhasa, and who wrote according to the materials which were available when he gave us that admirable edition of Marco Polo's Travels. You must understand that, apart altogether from the geographical knowledge that this expedition has brought back to us, it has opened a vast gate in regard to matters of ethnography and history which have been puzzles to some of us for a great time past. The whole of that Mongolian race which occupies the northern steppes of Tibet looks upon Lhasa as its Mekka. I have been asked why it is that these extraordinary nomads, the Mongols, who a few centuries ago overwhelmed the civilization of the whole of the known world, have become so peaceable and helpless and useless as soldiers, apparently the most helpless people that there are now on the face of the Earth. It is because they have been converted by the lamas to their form of Buddhism that two-thirds of their race live in monasteries at this moment. They have become celibates, they have given up their old military life and their rapacious habits, and whatever else has been done by these lamas of Tibet, they have succeeded in converting the most extraordinarily aggressive race that the world has probably ever seen into one of the most peaceful and the most quiet. Here from the Volga, where you have the Kalmucks at this moment, it is not far to go. Any one of you may go and see these Tibetans from the Volga right into middle China, where you have one continuous devotion to the faith embodied in this extremely corrupt form of Buddhism. Now, it is because we have still an enormous amount of ignorance in regard to the history of this region and of these people that one feels so grateful for this expedition, and that I have been so anxious, on behalf of the historians and the ethnographers and the archæologists, to add my humble testimony to that which has already been given by my two friends who have spoken.

The CHAIRMAN: There remains but very little to say on the wholly admirable paper you have heard read by Sir Frank Younghusband. There have been many points touched upon which would no doubt interest us exceedingly to discuss a little further. But as the time is late, I will merely refer to the fact that the geographical results of this mission may be described very shortly. We have succeeded at last in gaining a sound scientific basis for all those surveys which have preceded. You may know that for many years (since the days of Walker and Montgomery) native surveyors have traversed Tibet from end to end, and it is from the work they have accomplished that the maps we have hitherto had of Tibet have been constructed. Now we are able to give them that satisfactory and scientific basis they so long have wanted. We may hope that hereafter the process of exploring Tibet fully will not be stayed. Sir Frank Younghusband has said that he fears one evil may arise from the mission which he has so successfully brought to a conclusion, which is that the work of exploration will be greatly restricted in future. I don't think we need call that an evil. There is still plenty to be done, and I think we may safely say that those guardians of our frontier who think it so wrong to look over our neighbours' hedge will take care that we do not work too freely nor too fast. I will ask you now to join in a vote of thanks to Sir Frank Younghusband for his admirable paper, and to thank him, not only for coming here to-night in order to tell us of his mission, but for this added grace, that he has promised that if any large numbers of this society have been unable to find standing room to-night, he will repeat his lecture to an overflow meeting. This for a busy man like Sir Frank Younghusband is

indeed a great promise. I will now ask you to give your thanks to Colonel Younghusband for his paper.

Sir FRANK YOUNGHUSBAND, in response, said: I wish to thank you all for your very kind attention to-night, and for the very deep interest you have shown on behalf of myself and on behalf of all who accompanied me to uphold the great traditions of our race.

Owing to the fact that many Fellows were not able to obtain admission to the meeting on February 13, Sir Frank Younghusband kindly repeated his paper to a crowded audience on March 10.

After the paper, the PRESIDENT said: We have all listened with great attention to this most important and interesting address of Sir Frank Younghusband, and he has enabled us, better than we could do before, to realize the very great service he has done to geography, and the still greater service he has done to the State. We should remember that 120 years ago our first Governor-General had opened the same friendly diplomatic relations with Tibet, had established a trade, and had opened a fair for the Tibetans at Rangpur; but unfortunately his policy was neglected after his leaving India, and nothing was done, except in 1886, when there was just a chance of our sending a mission, which was not sent. All that time, until this great and important work was entrusted to Sir Frank Younghusband, Tibet was entirely neglected. Now, through the able work of this great public servant, we again have opened diplomatic relations, friendly relations, with these people. Only three days ago I received a letter from Lord Curzon, our Gold Medallist, in which he mentioned that he had had a letter from the Teshu Lama, and he looked forward to placing that letter by the side of the two letters which had been sent by the Teshu Lama in a previous incarnation to the envoys of Warren Hastings. Lord Curzon intends to place these letters side by side in his great Victoria Institute at Calcutta. The establishment by Sir Frank Younghusband of agents at Gyantse and Gartok will do what Warren Hastings intended to do, and open, in course of time, most important commercial intercourse between India and Tibet. It is difficult to express to you how strongly I feel towards Sir Frank Younghusband for these great services, and also for his extreme good nature in undertaking to read his paper to us a second time. You will join with me, I am sure, in passing a most cordial vote of thanks to Sir Frank Younghusband.

Sir FRANK YOUNGHUSBAND: I thank you for the very kind attention with which you have listened to my lecture this evening, and I wish to express my special gratitude to Sir Clements Markham for having come here to-night when I know with what difficulty he has had to come. He probably has a better knowledge of Tibet, from his study of it, than I suppose any Englishman up to the present time. I therefore feel especially gratified at the very complimentary remarks he has been pleased to make.

EXPLORATION IN BOLIVIA.*

By Dr. H. HOEK.

TOWARDS the beginning of September, 1903, we found ourselves, after a long and dusty journey, at Jujuy, the last station on the North Argentine railway, situated at the foot of the Cordilleras. Our little party, consisting of the leader, Dr. Steinmann, of Freiburg, Baron von Bistram,

* Read (by Mr. W. Rickmer Rickmers) at the Royal Geographical Society, December 12, 1904. Map, p. 588.

and myself, had now the pleasant task of searching for mules and servants, one in which we received valuable aid from Dr. Moreno, the well-known Director of the La Plata Museum. We resolved to give both man and beast a trial before concluding our bargains, and for this purpose chose the virgin forest of the Cordillera de Sapla and the Rio Garrapatal basin north-east of Jujuy, through which we rode to San Pedro. This typical example of a liane forest was absolutely untrodden, and in many places we had to hack our way through with the knife. We found much to interest us in the Cretaceous formation of the Garrapatal which contains bitumen and fish fossils. The hilly nature of the region tried our mules somewhat, and they were further tortured by the picos (sand-fleas), while we ourselves were the prey of the garrapatas or ticks. At San Pedro we reached the track of the new railway Perico-Ledesma, which at that time was working as far as San Pedro.

Our ariero (the name of an overseer of a troop of mules) appeared in a good light. A native of East Bolivia and of almost pure Indian breed, he nevertheless spoke Spanish well, could read and write, and was, moreover, quite trustworthy—a striking example, in fact, of the capacity for civilization possessed by the Quechoa Indians. The mules proving satisfactory, we bought sixteen of them, it being very expensive, and indeed almost impossible, to hire such for long journeys. Moreover, with an ariero and one's own mules one is practically independent. The export trade to South Africa has caused a considerable rise in the price of these animals. Whereas formerly one could be got for from 20 to 30 dollars, we had to give as much as 200 dollars apiece (£18) for our riding-mules. As Signor Moreno kindly proposed to accompany us as far as Rinconada, in the gold of which he was interested, we made a *détour* to the west instead of going straight to Yavi, the Bolivian frontier station which had been our original destination. The much-frequented road which until quite recently led from Potosí to Jujuy by way of Tupiza has been reduced to a desert by the construction of the Antofagasta-Oruro railway, so that now no facilities exist for sending things to Potosí.

On September 23 we left Jujuy, passing the night at the isolated posada "Volcan." Here, stretching for about 2½ miles into the valley, is an enormous cone of *débris* broken off from the Cerro Cordoba (15,500 feet), on the west. This mountain I climbed the following day, being anxious to determine its height, as well as to catch a glimpse of the mountains to the west (Chañi group). As it is possible to ride a considerable distance up the mountain from "El Volcan" (6200 feet), the tour can be done in a single day.

For four days we rode on through the stone-filled valley past Tilcara, Humahuaca, and the isolated house of Negra Muerta. Now and again the continuity of Palæozoic quartzite and slate was broken by Cretaceous sandstone (Petrolifera), the fantastic forms and variegated colour of

which were very striking. Crossing the desert-like Pampa Azul, where two lacustrine terraces are to be seen, we reached Cochinoca by way of a small pass. Here we had difficulty in replenishing our larder, the Indians obstinately refusing to sell either a living sheep or dead mutton. A long ride over a plain of deposits grown with grass and tola bushes brought us to Rinconada. The "tola" (*Lepidophyllum*, sp.) covers an immense area; in its appearance, as well as in the manner and extent of its growth, it resembles our heather. Halfway between Cochinocca and Rinconada, near the Angosta Queta, Steinmann found typical fossils of the lower Silurian age (Didymograptus). At Rinconada, which is famous for its gold-bearing quartz

QUEBRADER HONDA.

veins embedded in Palæozoic slate, we spent a day and a half, which Steinmann and I employed in climbing to the summit of the gently undulating mountain chain in the west, the Cerro Salle Grande de San José (16,690 feet), whence we took excellent bearings of the high volcanic groups in the north and north-west. While we were there a herd of vicunas passed quite close to us. On the salt swamps of Pozuelos, the remains of the lake which once covered the pampa of Rinconada, we had to remain a day, our mules having decamped.

Bidding farewell to Signor Moreno, we crossed the Cordillera de Escaya by a high pass (13,520 feet), finding in this chain granitic laccolithe in connection with Silurian slate.

On October 4 we reached Yavi, which lies at the foot of characteristically roof-shaped mountains of cretaceous rock richly studded

with fossils. The river which flows past Yavi falls into the Rio San Juan to the north, and from the heights to the west of the town we had a magnificent view of its barren, winding, cañon-like bed.

On October 7 we proceeded over the Pampa towards the north at a sharp angle to the long Victoria chain of mountains. This mighty range is the boundary-wall between the mountains of the west and the declining high land to the east. Further north, in the neighbourhood of the Rio Grande de Cotagaïta, it splits into numerous groups. The fossils found at Salitre, where we touched these hills, point undoubtedly to the Cambrian origin of the latter (*Agnostus*, sp.). Here the Victoria chain forms a kind of bay entirely filled with masses of recent *débris*.

VALLEY OF THE RIO LA PAZ, LOOKING EAST.

Further north the convergence of these chains forms the great plain of the Pampa de Tacsará. This is drained by the Quebrada Honda, which runs in a deep gorge in the south of the plain, and passes through the western chain.

Crossing the Abra Tincuya of the western range we reached the region of Tacsará, and caught a view to the east of what are probably the culminating points of the Victoria chain, the Cerro Campanario and its neighbours. To ascend the former and fix its height, and that of the neighbouring peaks, was our ambition, which we fulfilled on October 10, after a somewhat troublesome climb over rocky ground. To our disappointment, we had only a view to the west. Some 1640

feet below us a sea of cloud blotted out the landscape; but the fact that no peaks were visible above this pall of mist allowed the inference that the Victoria chain falls abruptly to the east. The Cerro Campanario is 16,665 feet, and shows no clear trace of glacial action.

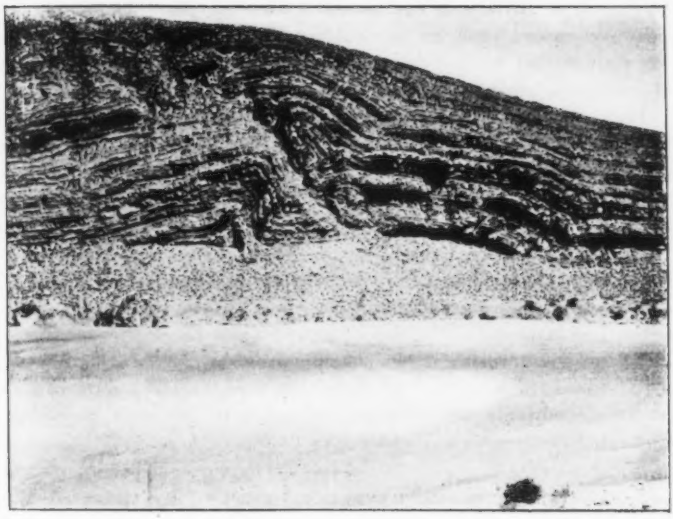
Proceeding over the Abra de Chorcoya (13,550 feet) northwards into the basin of the Rio Escayache, we crossed the Victoria range by the Abra de Sama (12,920 feet) to Tarija (6250 feet). A well-made but exceedingly steep road leads from the mountains to the tropical region of Tarija, a town formerly celebrated for its monastery which still contains the largest library in the country. Of the diluvian strata of this region and their celebrated fossils I need not speak.

The whole of this huge region descending to the east consists of a series of shallow folds or parallel chains cleft by the Tarija river on its eastward course. These chains are of different formation. Our descent from Abra de Same, for instance, took us over Silurian, an excellent place for finding Dictyonema being Cuesta de Erquis. The formation of the following chain is Devonian, that of the third Cretaceous, the deposits in every case lying concordantly. We spent six days in Tarija, where Steinmann succeeded in fixing the longitude by means of time signals from the Cordoba Observatory. On October 20 we left this beautiful and fertile landscape and crossed the cordillera a second time, on this occasion by the Cuesta de Escayache (12,000 feet) somewhat further to the north. After a two days' journey through deeply eroded mountainous country we reached the Rio San Juan, the northern course of which we followed until it abruptly turned eastward. Its isoclinal valley, consisting of Cretaceous sandstone, is continued to the north, and through it we passed over an unimportant pass into the valley of the Rio Grande de Cotagaïta. This river, which flows for a time from north to south in the same long isoclinal valley, also breaks through the eastern side of the latter to join the Rio San Juan on its way to the Rio Camblaya. This part of the valley of the Rio Grande, also called the Valle de Cinti from the town of that name, is a spot of Eden-like beauty, that is so far as the water can be used to fertilize it, the dark red of the soil and of the sandstone walls forming a beautiful background for the green of the foliage. Vineyards are the chief product of the soil, but, owing to the difficulty of transport, nearly all the grapes are made into brandy.

From Camargo (Cinti) we proceeded north, and then north-west by way of Tacaquira, Sivingomayo, and Otavi to Potosí. Here the great synclinal of sandstone in which we had ridden so long seems to come to an end. It is quite clear that a general surface of sandstone must originally have existed here, the remains of which are preserved only in great synclinals, ditches, and troughs. Between Sivingomayo and Otavi we crossed a second small trough of Cretaceous sandstone. For the first two days our course led through a mountainous country with

deep ravines void of protruding formation; indeed, it had rather the character of an eroded tableland.

Near Chichamayo we caught our first sight of the Cordillera de Liqui, and at Sivingomayo we reached a good starting-point for the ascent of the Cerro Liqui, the highest summit of the range, the height of which I fixed at 16,900 feet. From this point I gained a very clear idea of the orographical conditions of the surrounding country. The Cerro Liqui bears traces of former glaciers, unfortunately not very distinct, as it consists of slate which is not at all conducive to the preservation of glacial phenomena.



FLEXURE IN CRETACEOUS SANDSTONE, NEAR THE NEGRO MUERTA.

The following day brought us through the previously mentioned sandstone region of Otavi, the most prominent mountain of which is the Cerro Nnuqui. For a whole day we rode westward over the great Pampa of Lava to the foot of a mighty mountain range, the Cordillera de Andacaba, which, with its northern continuation of the Cari-Cari chain, we will call the Cordillera de Potosí. The map recently published by Germann represents it as covered with eternal snow, which is, however, by no means the case. Mighty moraines, up to 700 feet in height, surround the peaks of this cordillera, and this, the first unmistakable sign of former glacial action, induced us to avoid the direct route to Potosí and turn to the mountains in the north, where Señor Arzes' mine, Andacaba, gives the height of 15,378 feet, an excellent point

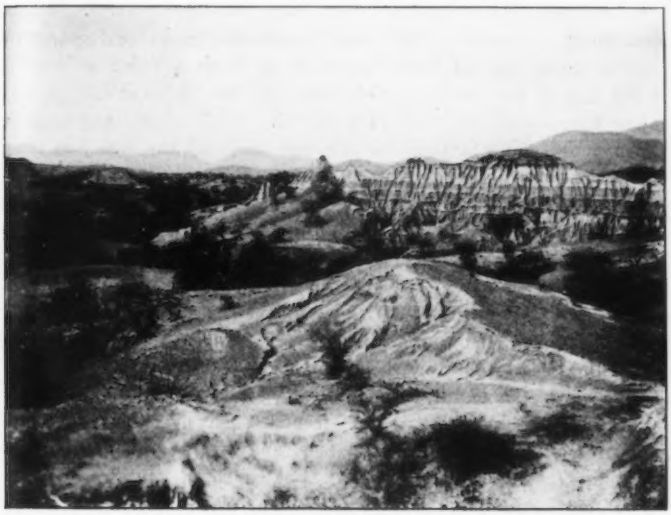
from which to start. We ascended the peaks Hembra de Andacaba (16,590 feet) and Anaroyo (17,100 feet), the beautiful weather allowing us an insight into the topography of these mountains, the mightiest chain we had met with since Jujuy, and one much neglected in all maps.

Riding westward on execrable paths and for a long way over enormous moraines, we reached Potosí on November 3. Of Potosí with its Cerro and its silver, I will not speak, as others worthier than I have already described it. I prefer directing your attention to a spot west of the town, where the mountain chain is cleft into a narrow ravine by a small stream coming from Potosí, and where a magnificent example of discordance, induced by folding, is to be seen. Or I would dwell on the charms of Miraflores, the beautiful watering-place whose roses and fruit trees afford such an agreeable contrast to the desert of Potosí. Hot springs and many Cretaceous fossils make this spot of peculiar interest to the geologist.

Leaving Potosí on November 11, we turned eastward, crossing the Cari-Cari chain by the Illimani pass (16,270 feet). A long descent over one of the most magnificent glacial regions imaginable brought us to San Bartolo, whence the direct route to Sucre turns to the north. Riding for the most part in an easterly direction, we crossed a narrow and somewhat deeply ridged trough of sandstone, reaching at length the northern continuation of the Pampa of Lava-Otavi, here much intersected by the northerly directed waters of the upper Pilcomayo. On the Rio Mataca (which flows north to join the Pilcomayo), at the foot of the mountainous region which forms the northern continuation of the Liqui-Nuqui group, we were for a night the guests of some friendly inhabitants, which made a pleasant interlude in our journey. Continuing eastward, we wound during two days up the heights between the separate waters of the Pilcomayo, taking special pains to understand this complicated and deeply ravined region. After climbing several high passes (Escaleras, 13,750 feet; Lampasar, 13,120 feet), we at length descended, on November 12, about 8200 feet to the Pilcomayo, which has here carved for itself a bed out of dazzling red sandstone. The combination of luxuriant tropical vegetation with the varied colours of the mountains and the remains of former settlements produces a picture full of magic beauty. Continuing north-eastward, we rode up the Rio Uyuni to Icla, where we devoted a day to the beautifully preserved Denovian fossils, amongst which the incomparable canularias are specially worthy of notice. The geography dealing with the origin and sources of the upper waters of the Pilcomayo is not of much value, and most of the maps of that part are drawn solely by imagination.

From Icla we proceeded to Sucre, passing the large Indian town Tarabuco (30 miles from Icla) and the smaller market town of Yamparaiz, between which the road traverses for a whole day the

watershed between the Amazon and the La Plata. Sucre, a town now practically dead, retains nevertheless some traces of its former splendour as the seat of government. Its vehicular communication with Cochabamba has ceased, while the post road is partly in ruins and useless for carriages at the present day. For three days we followed this route as far as Finca Constancia. The country here is a paradise of beauty and may best be described as a tropical park landscape. In the valleys there reigns eternal spring. All the cultivated plants of the temperate zone thrive, in addition to such tropical kinds as sugar-canes, bananas, and chirimoya, while swarms of green cockatoes fill the air with their screams. The Finca Caraparí, in particular, in the valley of the Rio



LANDSCAPE NEAR TARIJA.

Grande, would be a paradise but for fever. Our enjoyment of these beauties was short-lived, for with Aiquile and Mizque we entered a higher and more barren region. The latter, formerly a most flourishing place, has been almost devastated by fever.

To our chagrin we had to spend a day at the latter place because of the rain which had set in exceptionally early that season.

Mizque is separated from the fertile plains of Cliza and Cochabamba by the Khuri chain of mountains running east-south-east. An attempt to cut a good mule-path here had been abandoned, and our ascent of the Quevincha pass (12,350 feet) was made on a wretched and very slippery path at the end of which we had to camp in the rain. Continuing next day along the crest west-north-west, we found traces of former extensive

glaciers. A steep descent brought us to Arani, in the plain of Cliza, whose waters flow towards Cochabamba, reaching the Rio Grande by a very circuitous route.

On December 2 we reached Cochabamba (plain of wells). This town, situated at a height of 8530 feet at the foot of the imposing Cordillera of Tunari, was the centre from which we made our expeditions the following month.

Our next natural goal was the mighty mountain wall to the north of Cochabamba, whose summit is the double peak of Cerro Tunari. This mountain, as well as the whole range, was, on every occasion we saw it, covered with snow, but reports in Cochabamba, always contradictory, however, deny that it is eternal.

A first attempt to penetrate the range was unsuccessful. We had endeavoured to carry a tent and provisions from Iscaïpata, about 20 miles north-west of Cochabamba, to as high a point as possible, but the loss of two mules, which fell with the baggage down a steep slope on the way up, frustrated the design. Little of the lost property was recovered, and a further obstacle was made by the weather, which had become more than dreadful.

On December 14 we made another start, choosing for our ascent this time the wider valley of Llave, further to the west. At a height of 12,470 feet this valley forks, the western branch leading through a pass of 13,100 feet to Murachata, the eastern through one of 13,788 feet to Cocapata. At the point where it divides we camped.

The next day, after climbing through a steep snow gully, Prof. Steinmann and I reached the smoother north side of the Cerro Tunari, and afterwards the ridge between the two peaks. From this point I climbed the twin summits (17,060 feet). Their height was fixed by means of a boiling-point thermometer, and was corroborated by the continuous barometrical readings in Cochabamba.

The view to the north surprised us. The maps we had studied had led us to expect a gradual descent of the land on that side, instead of which there arose range upon range of mountains, some of which were at least 1650 feet higher than the Cerro Tunari itself. During our whole tour in the region of the Tunari we met with nothing but Palæozoic rocks. Glacial phenomena engaged our particular attention. As in the Alps, so here there are three great phases to be distinguished, a fact which later experience has since everywhere confirmed in South America, wherever we went. From the moraines of the first phase there stretch enormous deposits of fluvio-glacial origin, and these form the whole base of the Tunari range towards the south, cleft by the deep cañon-like gorges of the rivers issuing from the mountain valleys.

The week before Christmas Von Bistram and I rode through the pass Puca Puca (13,120 feet) to Colomi, and through the Abra de

Málaga (12,550 feet) into the region of the "Yungas," working our way over roads fathom-deep in mud, through forests and tropical rains as far as the Rio Espiritu Santo (3240 feet). This road had gained a temporary importance by the action of Brazil in closing the Amazon route to the export of Bolivian gum, owing to the Acre dispute. Throughout our journey from Cochabamba through Sacaba to Colomi and Incacorral, we met with nothing but Palæozoic deposits, Silurian and Devonian slates and quartzite. Beyond Incacorral the forest vegetation makes all geological observation impossible. It was particularly striking to note how far down on the eastern slopes of these mountains the traces of the glacial epoch extend, polished and scarred

CAÑON OF UPPER RIO PILCOMAYO—SANDSTONE WALLS.

rock-faces everywhere witnessing to the action of ice. It is evident, too, that the mountains on this side were more exposed to moisture during the Ice age than the so-called "puna."

In the mean time Steinmann had made an excursion westward to Capinote, a locality abundantly rich in magnificent Carboniferous fossils.

On December 29 we left Cochabamba for Oruro by the ordinary much-used and well-known mule track which leads through the passes of Tapacarí (13,920 feet), Confital (13,850 feet), and Incaracay (13,900 feet), past the localities of Paraotaní and Tapacarí. In addition to this path there is a carriage-road from Cochabamba to Oruro, open for regular traffic during the dry season, which leads through the village

of Capinote. I mention these well-known routes because they have been wrongly indicated on the recently published map by Germann. We stayed but a short time in Oruro, starting almost immediately for our expedition through the mountains of Santa Vera Cruz and Quimsa Cruz to Araca and La Paz. I may mention that in the immediate neighbourhood of Oruro beautiful specimens of old lacustrine terraces and tuff deposits are to be seen (cf. Minchin). We believe that there is some corresponding connection between these indications of voluminous lakes and the three glacial phases, seeing that both phenomena must be traced back to a wet and cold climate.

There exists great uncertainty as to the geography and nomenclature of the mountainous region stretching eastwards from the pampa between the valley of the Rio La Paz and the eastward bend of the Cordillera Real. This range is separated from the pampa almost through its entire length by the deep valley of Luribay, which here runs from south to north. Though a region rich in minerals and frequented, especially of late, by "mineros" (prospectors), exact details about it are nowhere to be found. Most travellers speak of a mountain "Quimsacruz," but, as a matter of fact, there is a range of mountains about 64 miles in length divided into three chief groups with numberless peaks.

During our tour in this region we localized the following mountains, all of which have been correctly indicated on Germann's map. The "Nevados of Araca," the direct continuation of the Illimani, a wild, mountainous region with beautiful peaks and numerous glaciers, nearly all of which look to the south; joining this on the south are the "Nevados de Quimsacruz" (more correctly Quimpsa, "Three"). The relatively deep gorge of the Abra de Tres Cruzez (15,160 feet) separates this group from the southern corner pillar of the whole range, the shining summit of Santa Veracruz (wrongly Velacruz). The eastern drainage of these three chains has so far been wrongly indicated on every map. On the west the Araca range drains into the Rio Araca, which itself joins the Rio La Paz before the latter breaks through the range. Ultimately the Rio La Paz receives also the western drainage of the Quimsacruz and the Santa Veracruz, which empty their waters into its tributary, the Luribay.

From Oruro we proceeded to Caracollo, and, turning east, passed the Cordillera at its eastward bend, where it becomes lower. After a four days' journey through the villages Colquiri and Ichoca, on the eastern side of the Veracruz range, we found ourselves at Quime. From here a relatively good road led over the Abra de Tres Cruzes (15,160 feet) to Yaco, whence we turned northward between the Quimsacruz range and the valley of the Rio Luribay, crossing several passes. After that, turning somewhat east, we passed the watershed of the Abra de Cairoma (13,225 feet), and reached the upper valley of the Araca.

On the eastern side of these mountains (Inquisive, Ichoca, Quime) vegetation and landscape have the character of the "Yungas," while the western side is puna-like in appearance, arid and sterile. The mountains themselves are high alpine and of a charming beauty. Their structure seems similar to that of the Illimani, a granite nucleus surrounded by Palæozoic deposits, whereon lie concordantly Cretaceous sandstones. As regards the height of the summits, I can only speak with certainty of those of the Araca range. Near the mine Viloco (13,290 feet), I climbed a rocky point from which was visible an overwhelming view of Illimani's rock wall rising sheer out of the depths of the La Paz valley. I fixed the height of my peak at 17,720

CRETACEOUS MOUNTAINS OF YAVI.

feet, and estimate the neighbouring snow-clad summits at close on 16,690 feet.

On January 4 we descended into the valley of the Rio La Paz, whence we climbed the Finca Cotaña; but I shall not venture to describe either it or the road to Cohoni and La Paz, as I cannot hope to equal Sir Martin Conway's beautiful description of this Bolivian high-level road. Moreover, our later experiences, our journey to Peru, our ride through the desert from Tacna to Coro-Coro, and my ascent of Cerro Tacora (19,900 feet) form another story.

I append a *résumé* of the scientific results of our (Dr. Steinmann's) expedition.

The map has been improved in the topography of the following districts. The northern end of the Cordillera de Victoria; the Pampa de Tacsara between Yavi and Tarija; the Cordillera de Liqui; the mountains in the east of Potosí, called the Cordillera de Potosí, and divided into the groups of Andacaba and Cari-Cari; the head of the Pilcomayo between Mataca and Icla; the range of the Cerro Tunari north-west of Cochabamba; the ranges of Santa Veracruz, Quimzacruz, and Araca, which form the continuation to the south of the Illimani group.

The height of about two hundred and thirty points has been determined by means of five aneroid barometers, which were regularly checked by boiling-point thermometers. The latitude of a great number of places in southern Bolivia was fixed, as also the longitude of Tarija and Potosí, the latter by telegraphic time-signals from the observatory of Cordoba.

As to the geology, I must confine myself to a very rough sketch of the general results.

The sediments found in South and East Bolivia are Cambrium, Lower Silurian, some traces of Devonian and carbon, and as the most recent marine deposit the deep layers of red Cretaceous sandstone, which under ordinary circumstances is only preserved in troughs and folds.

This entire system of sediments lies concordantly, with the exception of some places where differential movements caused by the folding process have disturbed the original concordance. The tectonic occurrences are very plain and simple. On the whole, we observe a folding structure on broad lines and of great dimensions. Nowhere do we meet with the complicated conditions reigning in the Alps. We were specially interested in the witnesses of former glaciation, and we have been able to establish three phases which correspond exactly to those of the Alps and North Europe. The necessary proofs were furnished by moraines in a state of more than excellent preservation. The more one approaches the equator the higher the snow-line, the greater, also, the elevation of ancient glaciation. We found it at 9515 feet in the Tunari, the Quimzacruz, and the Araca mountains. It is worthy of notice that the eastern sides of the mountains have always been exposed to greater moisture, and that therefore they show the remains of former glaciation at a lower level than on the western slopes. On the other hand, we observe that even the most southerly of the isolated volcanoes have borne ice-caps; thus the Cerro Tacora, which has a belt of enormous moraines as far down as 13,780 feet.

The lower level of the glaciation descends as we proceed further south, and thus keeps more or less parallel to the snow-line of to-day. Near Cochabamba it lies between 9190 and 9515 feet.

A former glaciation of Brazil is, of course, out of the question. Such

speculations as have appeared on the subject were due to a misinterpretation of certain phenomena.

Before the paper, the CHAIRMAN (Colonel G. E. CHURCH) said: Our paper this evening is on a very interesting section of South America, through the northern part of the Argentine Republic, and skirting the foot of the hills of the Andes and various points in Bolivia. I will now call on Dr. Hoek to read his paper.

After the paper, the CHAIRMAN said: We have the pleasure of having with us this evening Colonel Suarez, *charge d'affaires* of Bolivia. Perhaps he will favour us with a few remarks.

Colonel SUAREZ: I have listened with great pleasure to the very interesting lecture about Dr. Hoek's travels in Bolivia. I am very pleased indeed that some interest is being taken now in South America. It is not very long ago that I was invited to a country house in England, and when I arrived there I only found the ladies of the house-party. They were all staring at me, and I could not make out what was the reason. But soon I discovered it. One of the ladies of the house-party brought me her album, and asked me to write my name down and the country from which I came. I did so, and after having written "Bolivia," she asked, "Something else?" I said, "What?" "Something else?" I said, "South America?" "Yes," she said, "that is what we want." And then the lady of the house told me they had been discussing at length where Bolivia was; some said it was in South Africa, and some in Bohemia. When she told me this, I found out they expected to see me dressed in feathers. That is why I am so very thankful to Dr. Hoek, Colonel Church, and Sir Martin Conway, who have travelled there and given you some idea of Bolivia. You will see we are not quite in the state in which things were originally found. I hope at no distant date the country will be opened up with railways, and I dare say Messrs. Thomas Cook & Son will be selling you tickets and taking you over to make a few excursions up the mountains. I may tell you we have all sorts of climates there; you can choose your own. We have not such a pretty climate as you have in England, where in a few hours you have five or six changes; but, all the same, I think we could offer you some very nice climates indeed. I heard Dr. Hoek's remark that the principal industry is mining. It is so; but I may tell you that we also have indiarubber. The indiarubber that comes from Bolivia they call Para rubber, because it passes through the port of Para; the best comes from Bolivia, and is then shipped to Europe. We also have great opening for agriculture, as to which Colonel Church will be able to inform you, for he was in Bolivia some years ago, and he took great interest in that country, and I hope he will still do so. In conclusion, I have only to thank Dr. Hoek for his lecture on Bolivia.

The CHAIRMAN: I also see our well-known friend, Señor Aramayo, late Minister of Bolivia.

Señor ARAMAYO: I thank you for calling upon me to say a few words on this occasion, but I have nothing to add to the feelings already expressed by Colonel Suarez on behalf of Bolivia. I have only to say that I thank Dr. Hoek for his very interesting lecture to-night, which has instructed me on many points respecting the geology and geography of my own country; and I am sure it is very satisfactory to see that the exploration conducted by my old friend Dr. Steinmann has been so successful in Bolivia, and has given an opportunity to this Society to hear a good deal of the interesting resources of the country.

The CHAIRMAN: With your permission, I will occupy a few minutes of your time. I have read Dr. Hoek's paper carefully, and he is to be complimented on the information of varied character it contains. Once we get the accurate

map of his travels, it will be a great advantage to the geography of the region of which he has treated. But his paper once more opens the old question of the glaciation of South America—an ice age, of which he says there were in the Andes three marked epochs. We know that, so far as North America is concerned, the ice-cap extended south to about 35° N. lat. This paper brings forward prominently an ice age on the southern half of the continent, where glaciation extended north at least as far as 17° S. lat., at a point in the valley of the Amazon at about 5000 feet above sea-level, north of Cochabamba. Here Dr. Hoek found numerous evidences of glacial action. The theory of Agassiz as to the glaciation of the Amazon valley and of all Brazil has been, to the satisfaction of most people, completely demolished by the studies of the geological section of the Brazilian Government, and especially by the eminent geolcgist, Dr. John Branner. He has gone very thoroughly into this ice question, and finds that the crystalline rocks of Brazil, from Rio de Janeiro to the Amazon, are subject to a softening process. In the case of gneiss, granite, and diorite, the decomposition sometimes reaches a depth of more than 300 feet, and hard felspathic-porphyry is decomposed from 12 to 15 feet deep. Some of the Miocene rocks are decomposed to a depth of 370 feet, and in the carbonaceous formation as deep as 400 feet. This process splits off immense masses from the slopes of the mountains, and these are broken into fragments, large and small, which exfoliate on their edges and form boulders, that are piled up in such profusion that well may they be taken for moraines. This was true of a mass of dioritic boulders that Agassiz found 400 or 500 miles up the Amazon, on the north side, and which he took as morainic formation, but which was afterwards discovered to be composed of boulders of decomposition. Similar deposits may be found all along the coast of Brazil inland, and have all been proven to be of the same nature. Such softening of the rocks in the South American tropics goes on at a much greater pace than it does in the temperate zone. For instance, the amount of nitric acid and carbonic acid in the atmosphere, and especially the former, is very great, and is said to be formed from the electric discharges of the atmosphere, and this helps the decomposition process. Again, something which seems to have deceived a great many geologists, and made them think they were looking upon traces of glacial action, is the "fluting," examples of which are numerous in the Brazilian rocks. A drop of water trickles down, and ultimately a little stream forms a groove, until finally in the course of ages it grows deeper and deeper—anywhere from 6 inches to many feet. If my statements be correct, one has to accept the glacial theory with reference to Brazil and any part of the Amazon valley with reserve; but I have no doubt that the eminent gentlemen who have made these geological examinations now under discussion thoroughly understand that their views are in conflict with the geologists who have so exhaustively studied the problem of South American glaciation in Brazil. Dr. Hoek has been examining the slopes of the Andes—what shall I say? from 22° S. lat. up to 17°, where he found glacial action at a very low elevation, at the Amazon base of the Tunari range. This point is 360 geographical miles nearer the equator than Rio de Janeiro, in the vicinity of which the mountains rise to the elevation of 10,040 feet, mountains of such friable material that, had they ever been glaciated, they would have melted like sugar. It seems doubtful if any isothermal lines could ever have compensated for this difference of latitude and great elevation. But the glaciation of Brazil having been disproved, query, do we not require still further knowledge regarding these supposed glacial evidences reported from Bolivia before we can thoroughly accept the views set forth in Dr. Hoek's paper? May not his moraines also be boulders of decomposition? I do not assert that they are; but the question is interesting, and so able and devoted a scientist as Dr. Hoek will, I feel certain,

make it more so in the future. I have simply thrown out a few ideas; but I may say to Dr. Hoek I am not a professional geologist, only an amateur; but the two sides of the continent seem to be so in contradiction that we hope we shall have more information from Dr. Hoek himself. I was going to ask him to give it to us now, but, as he seems to be a little shy of his good English, we must hope that he will favour us in some other form later on. In any event, I think I express your sentiments in thanking Dr. Hoek most heartily for his paper, and also the very excellent mouthpiece he has brought with him, who, I may say, has adorned science with the eloquence of poetry.

A TRIP INTO THE CHILI PROVINCE, NORTH CHINA.*

By the Rev. JOHN HEDLEY.

It had long been my desire to take a trip through the Great Wall of China, and see for myself at least a part of that large tract of country known as the Chili Province. My travelling companion was Mr. R. J. Gould, sub-agent of the British and Foreign Bible Society in Tientsin, and the primary object of our journey was the dissemination of Scriptures. We started off from this ancient city of Yung-Phing fu (Eternal Peace), whose history can be traced back for 3000 years, on October 19, 1904.

Not only did we travel without escort, but without firearms of any description whatever, and when it is remembered that the district is proverbial for lawlessness, it says something for the local government that we were not once placed in any position where firearms would have been of value. The friendliness of the people was most marked.

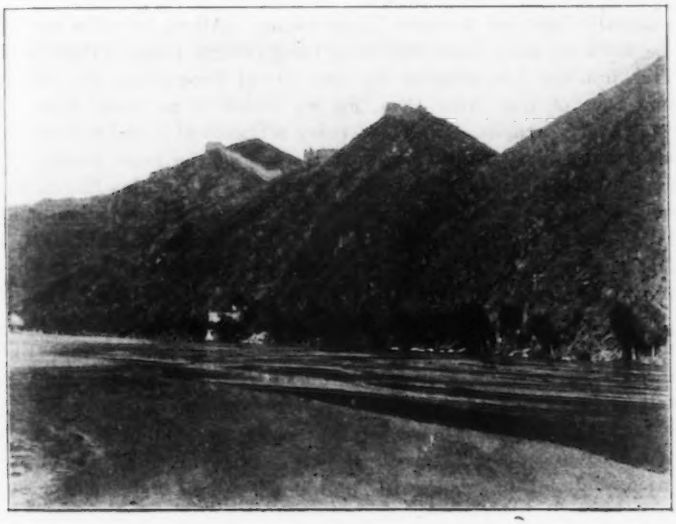
On October 22 we passed through the wall at Lŭng-ko (Cold pass). Lŭng-ko is the only pass for some miles round possible for vehicular traffic. Several other passes, as Liu-chia-ko and Tao-lin-ko, are in the vicinity, but boulders lie so thick that it is impossible for carts or barrows to get through. Animals and foot-passengers, however, use these passes regularly, and so reach their destinations quicker than would be possible were they confined to only one exit. At all these places custom houses are found, and taxes levied on goods passing to and fro. Books alone are exempt from duty, so we got through without any delay on that score. The pass at Lŭng-ko, through which the Sha Ho (Sand river) flows, no longer boasts the tower that once spanned the river, its place being taken by a sort of barrier made of inverted poles across the stream. The tower was destroyed by floods in the year 1850, and of course there has never been any attempt made to replace it. A very fine specimen of the ancient towers still stands at Liu-chia-ko, some 10 miles east of Lŭng-ko, of which a print was recently sent to the R.G.S.

* Map, p. 588.

Through the pass the road runs alongside the stream and under the shadow of the towering hills on which the Great Wall is built. The character of the scenery changes immediately, for whereas inside the pass the hills are for the most part barren, we were surprised to find the north side thickly studded with trees, not only making the landscape much more beautiful, but affording to the people a plentiful supply of fuel for the cold winter months. This continued until we had got some distance beyond Chaw-chang-ko, a distance of about 50 English miles, and, in response to our inquiries, we were everywhere told that within that radius fuel was the cheapest of the daily necessities. In the former part of this distance, firs and willows are most common; later, in addition to these, we came upon very fine poplars, while when we reached Chaw-chang-ko we found all the hills clad with a species of small oak tree, the branches and leaves of which make most excellent fuel. Indeed, the range of hills there takes its name from these trees, Paw-law Shan (Oak-tree hills), though, strange to say, the natives denied all knowledge of that name as applied to the hills. We also found that near the wall brown rice was grown, this being due to the presence of the Sha Ho, and men were even then busily engaged in banking up the river and diverting its course into their paddy-plots (they are too small to be called fields). That they appreciate home produce is evident from the answer we received as to its quality, "better than the white rice which comes from the south." The whole of this district suffered severely at the hands of the Hung-Hu-Tzus, often spelled Chung-Chu-Tzus (Red-beards) two years ago, the people everywhere fleeing to the mountains for refuge, leaving behind only a few elders to negotiate the ransom.

The road, lying in a fertile valley that varied in width from 400 to 1000 yards, was very good going till we reached the Manchu village of Tu-shih-munn (Earth-stone door). Here we came upon the first of the many "ling" (mountain range) we were henceforward to pass through. Two narrow defiles, not more than 8 feet wide, led us from Tu-shih-munn to Ta-shih-munn (Big stone door), and introduced us to a landscape still more beautiful than any we had hitherto seen. After this we were never very far away from high ranges and narrow passes, but the scenery was so varied and so full of interest that we almost forgot the weariness of body to which we had to submit. The approach to Chaw-chang-ko was one of the most fatiguing of all, and while we thought we had reached Chaw-chang-ko, we found we had only got to Chaw-chang-ko-munn, *i.e.* "the door of the valley." The inn we looked for was 2 miles further on. The light failed us before we reached the inn. Gold is found in the stream that flows through the valley here, but only in small quantities. The natives of this valley seemed a poorer and more wretched set of people than any we met on our journey. We started at 7 o'clock next morning, and at once found ourselves

climbing what seemed to me a sort of spiral staircase. Round and round we went, climbing higher each step. At one point we with our ponies were immediately over the heads of the carts travelling more slowly behind. The descent on the other side, though not of the circular type, was almost equally difficult. The "ling" is exactly a mile long, and some idea of the height of the hills may be gathered from the fact that, although the sun had risen before we left the inn, we had travelled just an hour before it touched us, and then only through a gap in the range. But what we had there was as nothing to what we met at Pa-hwaw-chih-ling, some 5 miles further on. We



SHA HO FLOWING THROUGH PASS AT LENG KOU.

quietly ascended the narrow path, but found it did not get easier as we mounted. The "ling" is more "spiral" and more difficult by far than that of our morning experience, and though we, unfortunately, had no instruments with us by which we could measure the altitude, we had climbed considerably more than 1000 feet—my friend thought at least 2000 feet—when we reached the top. There we were abundantly rewarded for our climb. Issuing out of the narrow defile at the summit, a scene of surpassing grandeur was presented to our view. It even moved the souls of our Chinese companions to speech, so it must have been unusual. Before us, glistening in the bright morning sunshine, were rank upon rank of towering mountains, the sandy face of those in the foreground showing up splendidly

against the dark purple behind. Absolutely nothing but hills and trees were to be seen. Not a hut of any description, not a single person or animal could be discerned. We seemed to have climbed to the roof! The hills here are known as Lama Shan (Lama mountains), and a garrulous guest at the inn where we stayed in the evening assured us that on the summit of the highest peak stood a temple called Wang Hai Miao (Look-at-the-sea temple), from which the sea in the vicinity of Shan Hai Kuan could be easily made out. This meant at least a view of 60 miles, and the tale was somewhat discounted by his later statement that this mountain was at least 40 li (13 miles) high.

Finding, after all our climbing, that we could not reach the town of Tang-tao Ho before late in the afternoon, we pushed on in a northerly direction towards Tao-urr-tung. About 10 miles south of the town we came upon the Ching Lung (Bright Dragon) river, which flows into the Lan river at my own city of Yung-phing fu. We had our share of that river then, for we forded it no fewer than nine times that afternoon, and next morning a branch of it had to be crossed seven times, as it flows from the hills east of the main stream. We passed within 2 miles of a gold-mine, worked by the China Engineering and Mining Co., Ltd., but which in recent years has not yielded much. At Hu-to-shih (Tiger Head rock), so named from a rock which is an almost perfect specimen of a tiger's head, prospecting for gold has been carried on at various times, but so far without success.

At Tao-urr-tung we came for the first time into contact with Mongolians, staying for the night at a Mongol inn. We were destined to see a great deal of these primitive people on our trip, and I may as well say at once that we were both most favourably impressed with them. My travelling companion, whose work in China had up to this year been in the vicinity of the Yang Tse river, was very much surprised, and, I think, not a little disappointed, to find that the men dressed exactly like the Chinese, wearing the queue and the blue gown, though the women differed from the Chinese in having large feet, a distinctive head-dress, and a very long upper garment coming right down to the heels. He had looked for conspicuous differences, forgetting for the moment that the Mongolians are divided into nomadic and settlers, the former living a roving life on the wind-swept plains of the north, while the latter inhabit the district in a part of which we were travelling. As a matter of fact, inner Mongolia was formerly inhabited by Mongolians only. But generations ago, the Manchu rulers, by a system which they euphoniously describe as "chieh ti yang min" ("borrow the land to support the (Chinese) people"), settled Chinese families amongst them; and now, in the pathetic language of an old Mongol woman with whom we talked one day, "the Mongols are less than half of the population." The villages, however, in their names, still retain memories of their former estate, many of them being known

as this "ying-tzu," that "chang-tzu," and so on. When it is remembered that a "ying" is a camp or a barrack, and a "chang" is a tent or an awning, we have in the nomenclature a record of a past that in many respects is obscure. The Mongols we met struck us as being a much quieter and more friendly people than the average Chinese. They were very free in conversation, even the women seeming to be pleased at any opportunity of speaking to us; so different from the Chinese woman, who, when she does not rush away at sight of a stranger, will hang her head in apparent modesty. Amongst themselves they speak in their own language, condescending to Chinese only when compelled. (Our Mongol landlord at Tao-urr-tung told us

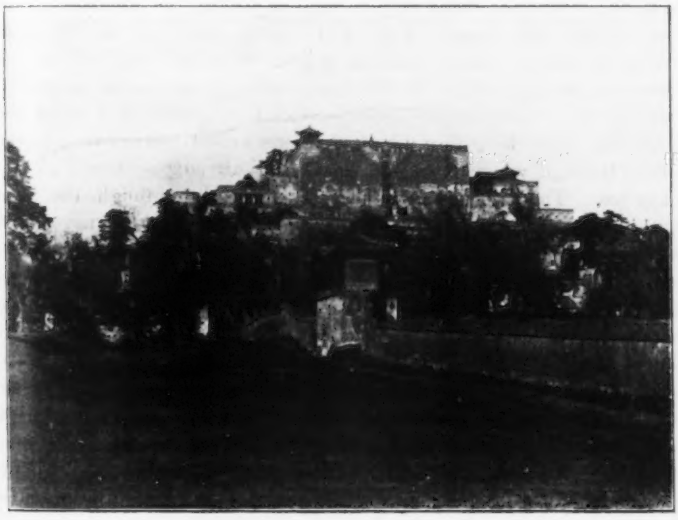
SCENE JUST IMMEDIATELY AFTER PASSING THROUGH LENG KOU, SHOWING CARTS.

that much of the language commonly spoken among the nomads was unintelligible even to them, the settlers.) They all speak Chinese with a soft liquid accent that reminds one of Hindustani, and invariably drop their voices with gentle cadence at the end of a sentence. The harsh strident tones in which the average Chinamen will salute you are never heard from the Mongols. There is no intermarrying between the two races. They dwell together, but are still apart. A man purchases his wife, paying over to her father money, pigs, and clothing. Without these three, he must remain a bachelor. Polygamy, of course, is allowed; our young friend almost indignantly asking me, "Why should not a man have more than one wife, if he can afford to buy

more?" To their religion the Mongols are fanatically wedded; their temples are everywhere in most excellent repair, and many of them really beautiful; lamas with shaven head and yellow robe abound wherever you go, until at Chung-tu fu (Jehol), in the vicinity of the temples, there seemed to be more lamas than laymen. But that, unfortunately, does not mean an overplus of righteousness, for some of the lamas are openly immoral, given up to opium and gambling. One of the most lovely temples I have ever seen, though it was not very large, that at Pai-niu-tsun, was in charge of an old lama who had a Chinese woman living in the temple with him; and we were credibly informed that lying and pilfering are regarded as but trifling matters by the majority of the people. Still, we liked them; their gentle manners and obvious friendliness being a great contrast to the obtrusive curiosity and bold impertinence of their Chinese neighbours.

From the pass at Pa-hwaw-chih-ling, which led us through a valley about 7 miles long, right up to Hu-to-shih, where for the fifth time we forded the Ching-lung river, the country was very bare and desolate. Trees were scarce, the hills were brown and barren, and there was but little land capable of cultivation, the road, like the curate's egg, being good in parts only. Here and there on the hillsides were patches of reclaimed land, some of them at such a height and angle that one could only wonder how animals or plough could stand there, much less work. But the Chinese agriculturist is nothing if not persistent and adaptive, and so many spots, that in another land and with another people would be left to stones and stubble, are diligently worked by these patient sons of toil. Sleeping one night at Tao-urr-tung, we next morning retraced our steps for 4 miles, and turned east through a wide valley that takes its name from Faw-ye-tung, a small market town some miles along. Here we came again on fertile soil, and after the desolation of the previous day, it was delightful to behold long stretches of splendid soil under the plough. Late in the season though it was, the people were very busy in the fields, and in many places we saw one set of men digging up the roots of the kaoliang (tall Barbadoes millet), which they use as fuel, and others following them with the plough, turning over the land in preparation for next year. Here no wheat is grown, but in such a year as this has been they get magnificent crops of kaoliang, short millet, and black beans. That night we stopped at Ko-munn, known also as Hsiao-ta-tze-ko, sleeping in a long room where some score or more of goatskins were drying, prior to being sold to representatives of Tientsin firms. We rose by mistake early next morning, being out of bed by 1.30, and on the road by 2.50. Early as we were (there was a glorious moon, and a sunrise never to be forgotten, so we felt quite virtuous), we were not the first astir, for that day was marked in the Chinese calendar as a lucky day, and the country seemed alive with people marrying and

giving in marriage. Our wanderings that day ended at Ta-chang-tze, a large and busy town, where we came into touch with the troops of General Ma Yu Kun (Ma of the Pearl mountain), which have been stationed all round this district since the opening of the Russo-Japanese war. A small river, too shallow for navigation, flows past the town to join the Ta-ling Ho at Kin-chau Fu, some 100 miles east. And when one thinks of the amount of business that is done in this and other towns in the vicinity, it seems a pity that no attempt is made to utilize a waterway that would so easily connect with the Peking-Niu-chwang railway. Tientsin firms have their representatives here, as in all the large towns of inner Mongolia, the purchase of skins being their



POTALA TEMPLE AT JEHOL, FACSIMILE OF POTALA AT LHASA.

principal trade, though Manchester cottons and American oil are everywhere to be seen. Skins are purchased from the people at the markets, one feature of the landscape being the immense flocks of sheep, goats, and oxen that the people keep. The skins, when dried and packed, are carried on mules across the mountains through Lŭng-ko to Hsu Ko Chwang, a station below Tongshan, on the Peking line, whence they are sent on to Tientsin. The distance thus covered by the mules is not less than 250 miles, but the cost of transit seems remarkably low. One hundred catties (about 133 lbs.) cost about 1*s.* 6*d.*, and as a mule cannot carry much over two hundred catties, it seems that a better means of transit might easily be found if the river at their very doors were only

dredged sufficiently to admit of flat-bottomed boats going up. The mules bearing their heavy burdens are constantly met on the road, one man often managing as many as ten or a dozen. They travel very slowly, but do their 33 miles a day.

From Ta-cheng-tze we turned westward to the city of Chien-chang hsien, better known by its local name of Ta-tze-ko. The latter name signifies Pagoda valley, so called because of a famous old pagoda of the Tang dynasty (A.D. 618–707) that stands a few miles west of the town. The pagoda is in a state of ruin now, and an eloquent parable of the old and new is afforded by the telegraph wire that runs immediately in front of it. The streets of Ta-tze-ko are broad and well kept, lined on either side with good shops, many of them in size and style quite equal to what may be seen in Peking or Tientsin. It is also a great trade centre, a speciality being, according to the sign-boards, the importation of Shantung goods. There are over 700 business houses in the city, while the total population is estimated to be well over 100,000. Like all the cities east of the barrier, that is, in the Mongolian part, there is no wall at Ta-tze-ko. It stands in a fertile valley, through which flows the small river already mentioned at Ta-cheng-tze. The two principal streets run right through the town north by south and east by west, and, though there is never that appearance of bustle that the smaller street of Ta-cheng-tze presents, yet all day and every day a great deal of business is done. Ta-tze-ko ought to have a permanent interest, not only for missionaries like the writer, but for all lovers of the adventurous and enterprising. It was in this city that James Gilmour, whose books on Mongolia have the double merit of accuracy and entertainment, lived and laboured for so many years, after he had toiled, and, to human appearance, failed in his work "among the Mongols."

Both at Ta-cheng-tze and Ta-tze-ko coal is commonly used by the people. It is produced at a place named Phing-ku, 33 miles south of the former town, and carried by mules in baskets over the mountains at a price which works out at a little over $4 (7*s.* 6*d.*) per ton. The coal workings are entirely in the hands of the Chinese, and are said to be little more than surface borings in the sides of the hills. One old man we met in the inn at Ta-cheng-tze assured us that, to his certain knowledge, coal had been produced at Phing-ku for at least fifty years.

At Ta-tze-ko, as at various stations along the main roads, are contingents of General Ma's troops, all seemingly suffering from *ennui*, due to lack of occupation. The exception to this is at Phing-chuan-chau (Peaceful Spring), otherwise known as Pa-ko (eighth valley, counting from Peking), where the general has his headquarters, and the soldiers are kept hard at daily drill, being in consequence a fine, sturdy set of fellows. But none of them showed any anxiety to assist

PASSENGER BOAT ON LAN RIVER.

Japan to turn the Russians out of Manchuria, of which some newspapers have been making so much of late.

Pa-ko is as fine a town as one need wish to see, while Jehol, of which more anon, is about the most beautiful and inviting of North China cities. Pa-ko, true, boasts but one business street, but that one street is 7 *English miles* long. The shops, as you advance into the town, are equal to those in Ta-tze-ko. The street is fully 30 feet wide, and the constant passing to and fro of carts, big and little, pack-mules and camels, mule-litters and donkeys, to say nothing of men, women, and children, is enough to keep the stranger interested for many hours, and assure him that a considerable amount of money changes hands daily. Coal is found in large quantities within comparatively short distances of the town, while gold and silver mines are worked in several places. The Imperial post has not yet extended its system outside the wall, but the telegraph company has had stations in all these cities for some years, and the poles and wire across the mountains give quite a modern touch to the landscape. The management is not quite so precise as it might be. From Pa-ko to Jehol is a trip to be remembered, if only for the Hung-shih-la-liang-li-hsia (Red Rock pass) which has to be negotiated. From start to finish this pass is over 3 miles long, and the descent on the Jehol side is so steep and precipitous that it is necessary to attach ropes to the back of the carts and have a few men hanging on behind. Fortunately for us, the

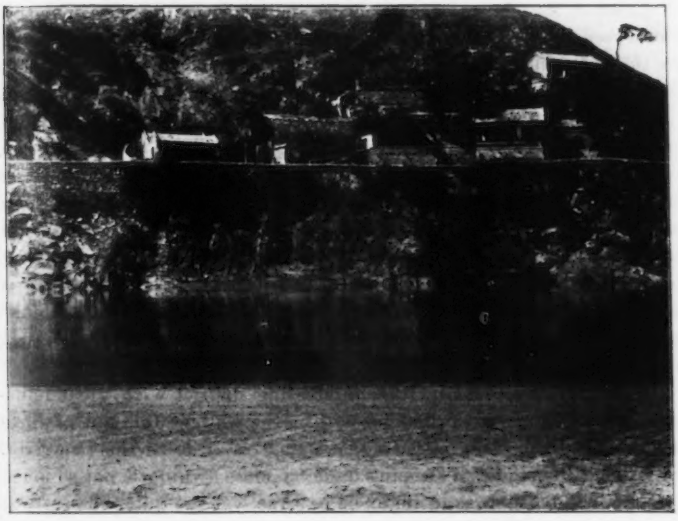
road had been recently repaired—a most unusual thing in China—else we could scarcely have hoped for so satisfactory an issue to our trip.

Here, also, in several places we observed large grain baskets filled with heavy stones and partly buried in the earth. My friend thought pilgrims to Jehol had been putting in a few "good works" on the way, by taking up the stones out of the paths. The true and prosaic explanation proved to be that they acted as dams for the rushing water from the mountains in the rainy season, and prevented the carrying away of the crops. In many villages we saw what appeared to be large bundles of straw lying in pools and firmly held down by huge boulders placed at regular intervals upon them. This proved to be the local method of treating hemp, which is thus thoroughly soaked for about three weeks, taken out, and dried in the sun before being worked up into ropes.

Turning northward out of the Red Rock valley into the valley watered by the Je Ho (Hot river), 2 miles away, a beautiful view of the city of Chung-tu Fu (Jehol) (Complete Virtue city) bursts upon the traveller's sight. No city wall obscures the prospect, the houses being built on the sloping hills. Trees and temples add to the harmonious setting, and surmounting all is the wall enclosing the imperial palace grounds, 6 miles in extent, built by Chien Lung over two hundred years ago, and where the unworthy Hsien Fung ended his miserable days (the Chinese would rather say, "became a guest on high").

KU LUNG SHAN (CAVERN HILL) ON LAN RIVER.

Here, too, the shops are numerous and good, though the streets are not so wide as at Pa-ko and Ta-tze-ko. Admission to the palace grounds is possible only on production of a permit from the Wai Wu Pu at Peking, and future travellers would do well to provide themselves with such an authority. Though we could not, therefore, see through the palace, the Tartar general courteously provided us with a guide to the temples, for which the city is famed. These temples, five in number, lie 4 miles north of the city, and the view they present, especially when, as we first saw them, a brilliant sun is glistening upon them, is something to dream about. The valley is well wooded, to begin with; all round are the everlasting hills, so that nature's environments lend



LUNG WANG MIAO (DRAGON KING TEMPLE) ON LAN RIVER NEAR LANCHOU, SAID TO HAVE BEEN BUILT TO PLEASE AN ANCIENT EMPEROR. THE ROAD GOES THROUGH A TUNNEL BENEATH THE MAIN HALL.

their beauty to the works of man. Two of the temples are roofed with brass tiles, which are said to have had a coating of gold, while magnificent fir trees, the Chinaman's pet, fill all the courtyards. Naturally, to us the Potala temple was most interesting, not on account of its beauty, but in view of recent events in Tibet. This temple at Jehol is said to be a miniature copy of the Potala at Lhasa, of which we have of late heard so much. There are a great number of lamas in residence here, some say seven to eight hundred, but on the day of our visit they had all gone out to see the theatre erected in the valley. We did not, therefore, get inside, but we were the less inclined to grieve over that, since

all temples in China are more or less reproductions. The exterior view claimed all our interest and time, so unlike anything else to be seen in China. The main building, standing four-square, looks more like a mediæval castle than a temple, and is an imposing sight. Here Lamaism in inner Mongolia finds its principal home, and exercises an influence which none can fail to feel. The Lo Han Tang, at the far western end of the same valley, is notable for its galaxy of 508 Buddhist worthies, all made of wood, yet gilded to look like gold, and kept in perfect condition. The doors of this temple are usually kept locked, and opened only for special visitors. But as we were leaving we found the janitors earning an "honest" penny by allowing the people in on payment of a few cash each.

At Jehol Manchus seem to compose the larger part of the population, and of women, with their peculiar head-dress, we saw a great number at the theatre mentioned above. We also noticed that all the Manchu boys wear a plain earring in one ear, the reason given to us being that it was a preventive against disease, and commonly practised among the bannermen. The hills in the vicinity of Jehol are of quite a distinct type, assuming most unusual and fantastic appearances. One peak resembles an incense-burner, and is called Hsiang Lu Shan (Resembling Censer hill); another is named Ha Ma Shan (Frog hill), being exactly like that amphibious animal; while one hill which we passed, in the distance stood up like our own St. Michael's Mount, but when we got nearer seemed a miniature of the Giant's Causeway. All about game is found, and in great abundance, as witness the fact that in the season pheasants can be bought for a sum equal to 1*s.* per brace.

We turned our backs on this interesting district with great reluctance, but other duties called us within the wall at the end of three weeks. We finished up by sailing on a small boat down the Lan river, and although four nights sleeping under a mere awning is not so much of a joke in November as it might be in June, yet the quiet change was very enjoyable. The distance from Jehol to Lanchau is roughly estimated at 200 miles, and though that seemed to us an extravagant estimate, yet when we found how the river twists and turns in and out of the massive mountains that rise up sheer from the water's edge, we felt our Chinese boatmen were not so far wrong. The river is navigable for about 100 miles above Jehol, that is, as far as Fung-ning-hsien, and flows into the sea about 30 miles south of the railway at Lan-chau. The traffic is considerable, and the boats—rough, flat-bottomed, crazy-looking affairs—are legion. A great trade is done in timber, fruit (principally pears), peanuts, and incense powder, while kerosene oil and cottons are sent up inland. Not the smallest part of the pleasure—and risk—lies in the shooting of the numerous small rapids which are met on the river, and the alert and ingenious manner in which the boatmen manage their craft is worthy of even a Westerner's admiration. At most of

these rapids (of which in one day I counted thirty-one) are water-mills devoted to the grinding of trees to make incense. The trees are chopped into small pieces and thrown into a hole in a heavy millstone, which revolves on a larger stone as the water rushes through below. In the rainy season, when the river flows full and fast, they can grind on a pair of mills two hundred catties per day. It is made up into bundles of this weight, and sold on the spot for fifty strings of cash (about 25*s.*), whence the bulk of it is transported into Manchuria to be made up into fragrant incense-sticks. Idolatry is therefore profitable to others besides priests. The river is a sportsman's paradise. The trip down the river took four days, but was full of an ever-changing charm. We passed through the wall at Pan-chia-ko, where, as at Lŭng-ko, the tower has disappeared, carried away by floods in 1883. Late at night, on November 10, we brought up at Yung-phing Fu; next morning joined the mail-train from Shan-hai-kwan at Lan-chau; and our delightful trip of over 550 miles was a thing of the past, to remain a pleasant memory for many years to come.

A JOURNEY WEST AND NORTH OF LAKE RUDOLF.*

From Notes supplied by J. W. BROOKE.

In August, 1903, the East African Syndicate despatched an expedition to the little-known country extending north from Mount Elgon, on the west side of Lake Rudolf. Four white men were sent, one of whom, Mr. J. W. Brooke, furnishes an account of the country traversed, accompanied by a map of the route, which we here reproduce.

Mount Elgon consists of a foundation of gneiss overlaid with dust, ashes, and scoriæ; but Dabasien, a little further north, is almost entirely lava, the intervening space being occupied by a highly contorted schist with quartz. North of Dabasien there are hills some 1000 feet high, almost perfectly pyramidal, whose origin is a difficult problem. The Karamojo and Jiwi countries, through which the route lay, are mainly volcanic, being traversed by sharp volcanic dykes which rise precipitously some 500 feet out of the flat alluvial plains. Dodosi is, however, slightly more interesting. To the north-east, after a range of mountains has been crossed, the ground sinks by a precipitous step to a volcanic plain covered with thorn bush about 1900 feet above sea-level. It is only practicable just after the rains in August and September. A large river, hitherto not marked on the maps, and for which no name could be learnt, flows west from the Lubur mountains and disappears in the sands; and as the western hills also shed their water in this direction, the plain must be converted into a lake of mud during the rains. On the foothills of Lubur (which was recognized from its

* Map, p. 588.

contour as shown in Major Austin's map) shell-beds 500 feet above the lake were found, containing species identical with those in the lake, and thus proving that the levels have changed considerably. The lake is fed by numerous saline springs on the shore, as well as from the sides of Mount Lubur. The mountains round Rudolf seem slightly older than the rift-valley volcanoes, and no signs of hot springs were seen. On reaching the most north-easterly camp, two of the party ascended to the plateau, which reaches an altitude of 6000 feet, or 3000 feet higher

MASAI WARRIOR.

than the plain below. Above, the country and climate are described as the most glorious imaginable—the hills terraced from top to bottom, and springs issuing from the higher levels and trickling from terrace to terrace to the valleys below. The hills are volcanic, but much older than any seen previously.

After a westward march of 90 miles, the plateau was left and a river reached, which seemed to be the stream shown by Wellby as the upper course of his second or Western "Ruzi," though the only name

KARAMOJA WARRIOR.

obtainable for it was Koron.* Mr. Brooke thinks that it flows in a westerly direction without turning north. A salt spring in this neighbourhood was quite undrinkable, but south of the hills of Moro Agabi a clear spring of beautiful water was found. In the district of Dabossa, which was visited, the river Lora completely disappears under the volcanic soil, but its eastward course is marked for a long distance by a line of trees. The Kideppo is likewise lined with Borassus palms and thick undergrowth. On reaching Morongole, some trouble was taken to fix the position of Mount Mogila (apparently the Tirano of Dr. Donaldson Smith,† though this name was not heard), and it was

* Mr. Brooke says that the name Ruzi was quite unknown here, but it may be observed that the French traveller, M. du Bourg de Bozas, found every watercourse described as Ruzi in the Turkana country.

† *Journal*, December, 1900. Of the other place-names mentioned, the Moro Agabi hills seem to represent the Mount Agabi of Dr. Smith; while Dabossa was shown as an extensive district in Colonel Macdonald's map (*Journal*, August, 1899), and Morongole as a mountain to the north-west of Karamojo. Mounts Etua and Hogo also appear on Dr. Smith's map.

found to be placed 30 miles too far north on previous maps. Mr. Brooke's map was checked by bearings (with a 5-inch compass) to known points, including Mounts Morongole, Singhoti, Etua, and Hogo (or Naita).

Of the tribes with which the expedition came in contact, the Karamojo (whose language extends up to Southern Abyssinia) are described as treacherous and of a low negro type, sooty black, though splendid runners, and averaging over 6 feet in height. They wear the Turkana pad plastered with mud at the back of the head, also iron and ivory bracelets and iron collars. They are very excitable and objectionable, and one must be careful in dealing with them. The Ijiwi * have more refined features than the Karamojo, but are equally excitable. The true Turkana (so called in distinction from the nomadic Turkana, who are a wild set of outcasts) are dark olive in colour, have aquiline features and slender limbs, though their eyes are small and fierce, possibly owing to their continual use in hunting. While in the neighbourhood of Lake Rudolf, the advance guard of an Abyssinian force was encountered, and made a favourable impression from their clean and smart appearance and courteous bearing. They are described as

FOOTHILLS OF MOUNT ELGON.

perfect riders and born soldiers, and were armed with French and Russian rifles made in about 1874. They had raided between 30,000 and 40,000

* Mr. Brooke says that this tribe is quite distinct from the Igiai of de Bozas (*Journal*, vol. 21, p. 320).

GRAZING LANDS OF NAIVASHA.

head of stock, as well as a great many slaves. They were living in large, well-built huts, which they shared with their horses, and only in the case of the more aristocratic were the huts kept clean. Their women are badly treated, and do all the indoor work, while the men sleep when they are not raiding or eating. The chief articles of trade seem to be broad-brimmed hats, rugs, blankets, white linen, copper cooking-pots, swords, clocks, etc. The Marle, who live near the north end of Lake Rudolf, were found to be living on fish, their crops having been destroyed by the Abyssinians. Their huts were hidden away on little sandy hills in the dense rushes surrounding the lake.

The Tilma, Menu, and Mŭrrile are small tribes subject to the Abyssinians, living on grain and honey. The women all slit the lower lip and insert a plate of wood that projects 3 inches from the mouth, while the Mŭrrile wear curious iron chain petticoats that weigh some 20 lbs. The men are tattooed on the right shoulder, and have aquiline features, while the manner of dressing the beard and hair recalls pictures of the ancient Egyptians. The Mŭrrile speak the Karamojo language, and are not closely allied to the Tilma and Menu, though all have Hamitic affinities. The Dabossa people were friendly, though unable quite to make out who their visitors were. They are strong and well-made negroes resembling the Karamojo, and are quite a match for the Turkana in a fight. They wear wrist-knives, and own large numbers of fine cattle. The people of Zulia had recently been exterminated by the Dodinga. Those of Mpuri are probably Hamitic, and are friends with every one, a rare occurrence amongst these tribes, who live at constant enmity, though it is only at rare intervals that an attack in force, leading to the extermination of an unsuspecting neighbour, is made. The Mpuri live on game and on the Mwali grain that grows on the mountain-sides. They make up their forefathers' hair into the

form of a hat (in place of the pad seen elsewhere). It is ornamented with cowies, and droops down over the ears and back of the head, being plastered on with mud, which must be dissolved in water before it can be taken off.

The Karamojo were evidently once the dominant race, but as a result of rebellions, as well as of the Hamitic invasion (which would also account for the hill tribes, like the Mpuri and Mŭrrile, with their refined features), became split up into smaller tribes.

Game of all kinds abounds where there are no natives, and large herds were seen congregated around the water-pools north of Dabossa. The Steyn buck and lesser koodoo prefer dry bush-covered country, and the former were seen (together with pheasants and partridges) around dry river-beds with no water within 20 miles. They feed on the succulent cactus. Huge pythons were seen during the march to Lake Rudolf, and not far from the lake-shore myriads of bats were found living in cracks in the volcanic soil. They flew away in clouds over the lake, returning to the same spot every evening. A baboon measuring 4 feet at the shoulder was seen on the Kabeish river just south of the Abyssinian plateau, and is probably a new species. One of the party had the good fortune, also, to see a pack of wild dogs hunting. They follow their leader in single file, taking advantage of every possible cover on approaching an unwary herd of zebras. A new species of crow, with two white marks on the top of each wing, was seen on the Abyssinian highland. The party was, however, handicapped as

BASALTIC CLIFFS SOUTH OF LAKE NAIVASHA, CAUSED BY SUBSIDENCE OF THE LAND BETWEEN.

regards natural history investigation by want of time and transport facilities.

The most valuable product of the country is ivory, the exploitation of which, however, needs to be properly controlled. At present the Swahili muster in force amongst a friendly tribe like the Dabossa, and then raid the Turkana, taking stock, which they trade for ivory with friendly natives, and making slaves of the women and children. Great numbers of elephants of all sizes are killed; consequently, the export of ivory is far greater than it should be, but it is hoped that by now this may have been remedied. The Turkana country is now comparatively safe to travel through, a good impression having been made by the return of a Turkana woman who had been carried off by the Swahilis. The country round Elgon, with its abundant supply of rain all the year round on the higher ground, should be profitable to the farmer. Elsewhere the natives obtain water by digging deep wells in the river-beds. The expedition had some difficulty in regard to water-supply, but a month earlier this would not have been the case. The Swahili, though wonderful porters and splendid at roughing it, cannot be taught to pack donkeys, which are far and away the best transport-animals for this part of Africa. They are, however, liable to the attacks of the tsetze fly, to which all the animals of the expedition succumbed after reaching the Kabeish river.

A NEW ISLAND.

JAPAN is undoubtedly a land of surprises, and for sudden and violent displays of plutonic and seismic activities it would be difficult to find her equal. Sometimes she is creative and sometimes destructive, but as a builder of islands and a remover of mountains she is *facile princeps*. The "*Mons excelsus et singularis*" of Kaempfer, the Great Fuji, 13,000 feet or thereabouts in height, we are told reached its present position after a cross-country march of 200 miles in a single night. In 1888, Mount Bandai, a peaceful-looking old hill which for countless generations had smiled upon villages and lakes around its base, without warning blew off its head and half its body, and in ten minutes a well-known landmark was no longer recognizable. While Pelée was still muttering over its holocaust at St. Piérre, Japan, as if seized with an idea to keep abreast with all things that pertained to Europe, by an eruption buried all the inhabitants on Bird island (Torii Shima).

Now news reaches us from the south of Torii Shima that an island 480 feet high, $2\frac{3}{4}$ miles in circumference, has already sprung into existence. Its growth was watched by the inhabitants of Iwo or Sulphur island, near the Bonins. On November 14 they were startled

by strange rumblings. Two weeks later they saw great clouds of black-and-white smoke, or, in other words, clouds of black ash and steam. Next the sea appeared as if it were on fire. What they saw was suggestive of a fight between Vulcan and the ocean. When, in 1883, the Indian ocean poured down the red-hot throat of Krakatoa, angry resentment was announced by explosions and thunderings which were heard from the centre of Australia to the Mauritius. At Nii Shima, as the new island has been christened, although no one was near

enough to tell precisely what occurred, the struggle between the Pacific and the internal fires was conducted in a manner much less boisterous. At Krakatoa Neptune was victorious, and the sea put out the volcano; at Nii Shima, in spite of a watery load of 6000 to 10,000 feet above his back, Vulcan's head and shoulders now look round upon the Pacific. How this was accomplished without expectant ears in Japan and China picking up sounds suggestive of an engagement between opposing fleets, it is difficult to understand.

At first a little island appeared amidst the smoke. Later it seemed

as if there were three islands. On December 12, instead of three islands, one large island was seen standing in the sea. From day to day this changed in its configuration, and those who watched it were anxious as to what might happen next. To allay alarm and find out what had occurred, ten men set out in a 30-foot boat and a canoe. They reached the island on February 1, and placed upon its summit a flag with the inscription, "New place. Great Japan. Many Banzais." The south coast is reported to be a precipitous mass of rock, while on the north there is a boiling lake. After such Titanic efforts, this new addition to the empire of Japan may be expected to fly a flag of steam above its lake for many years.

If we draw a line from Fiji to Bonin, which may be continued both towards the north and towards the south, we find it is a line studded with volcanoes, and a number of these have been created within historic times. Where it crosses Japan, we see it as the "Magnum Fossa," or Great Fault, to which attention was first drawn by Dr. Edmund Naumann. Its suboceanic continuation is also a line of yielding, and it is along this that Vulcan has so often forced an opening, and in the form of islets and islands left monuments of the power that can be exerted by the imprisoned vapours within our world. Two other regions in which Japan, for similar reasons and in a like manner, is still adding to her territorial area, are to the south of Kiushiu and to the north of Yezo. In both these districts we can see these mushroom-like creations still "smoking." The Ainu name for the Kuriles, which form the northern line, means "the Smokers," while the name Kurile itself is apparently derived from the Russian "Kooreet," to smoke.

The phenomena which accompany the birth of islands, such as those which took place in the early part of this year at the birth of Nii Shima, form foundations for the same old story. At the opening of the sixth seal, as described in the Apocalypse, the Seer of Patmos recounts what we may well have seen in the Ægean sea. The sun and air were darkened by smoke from the bottomless pit; there were lightnings, thunderings, earthquakes, an atmosphere of brimstone, a hail of fire; the sun became black, a mountain was burning in the sea, and islands moved. Occurrences such as these have often been witnessed in volcanic regions, and, unfortunately, have frequently been accompanied by great loss of life. This, we are glad to say, was not the case at Nii Shima, from which the ten adventurers returned in safety.

J. M.

GLACIAL RESERVOIRS AND THEIR OUTBURSTS.

By CHARLES RABOT.

GLACIERS, acting on the soil slowly but continuously in obedience to glacial dynamics, give rise from time to time to the violent torrential outbursts known in French by the name of *débâcles*. Far from being rare and accidental, as is commonly supposed, these outbursts are relatively frequent, constituting a normal form of glacial action.

The occurrence of such phenomena presupposes, first, a reservoir of water, and, secondly, its *sudden* evacuation.

The formation of the reservoir may be due to one of three principal causes—

1. The reservoir may be the result of a disturbance, effected by a temporary increase or decrease of a glacier, in the channels and outflow of streams external to it.

2. The reservoir may be the result of a disturbance, permanent throughout a period of considerable duration, effected by a glacier, in the channels and outflow of streams external to it.

3. The reservoir may be situated in the glacier itself, and its creation, as well as its alimentation, be due to the physical properties of the ice. Such a reservoir is the glacier lake, properly so called.

The first of these examples may have been produced in one of three different ways—

(*a*) A glacier, while advancing, chokes up a valley or glen at right angles or oblique to its own course, and by stopping the overflow of its waters causes the formation of a barrier lake (*lac de barrage*) during the period of advance. A well-known specimen is supplied by the Vernagt glacier in Tyrol.

(*b*) A glacier, encountering in its descent a cliff overhanging a valley, falls to pieces, which subsequently unite to form a new glacier (*glacier remanié*) at the base of the precipice. Should the ice increase, the "*glacier remanié*" may choke up the valley and give rise to a temporary barrier lake. The glacier of Giétroz in the Val de Bagnes is an example.

(*c*) Where, of two glaciers previously united at their lower extremity, one retreats more slowly than the other, so that the first blocks the passage of the waters issuing from the second, and compels them to accumulate in a lake. The glaciers of Otemma and of Crête Sèche in the Val de Bagnes, from 1892 to 1898, furnished a specimen of this class.

Let us now turn to our second example, in which the formation of the reservoir is due, not to glacial variations in length, but to topographical circumstances coincident with the general state of glaciation. A glacier chokes up, in a manner relatively permanent, a lateral ravine; or the ice may simply dam with its moraine a stream flowing off the enclosing mountains, thus giving rise to a Border Lake (*lac de bordure* in French, *Randsee* in German), which will endure as long as the barrier does. The best known example of the glacial *Randsee* is the Märjelen See near the Eggischhorn.

In our third example, that in which the reservoir is contained in the ice itself, three sub-varieties may be distinguished—

(*a*) When the surface meltings of the glacier fill an open hollow—a Surface Lake.

(*b*) Where a reservoir of water is formed in a hollow under the glacier—a Subglacial Lake.

Or (*c*) Where in the heart of the ice—at least in the case of the great glaciers

of the Arctic and Himalayan regions—pools of water are formed, distinguishable as glacier Ice-pocket Lakes.

The second condition required for the production of a water-burst is the *sudden* collapse of the reservoir.

The action of water on ice resembles that it exercises on limestone, as has been demonstrated by Dr. R. Sieger in his "Die Karstformen der Gletscher," in *Geographische Zeitschrift*, 1895, 3 and 4 (Leipzig). The causes which tend to the formation of rock caverns go also to the formation of glacier cavities, namely, the pre-existence of fissures, erosion, corrosion, and hydrostatic pressure, to which must be added the action of air having a temperature above 32° Fahr. The waters of a glacial Barrier or Border Lake, or of a Subglacial or Ice-pocket Lake, in this way tend to scoop themselves out a passage through the mass of ice confining them. Should the opening of the passage occur suddenly, the result is a burst; but if effected gradually, the emptying of the reservoir causes no more than a marked increase in the torrent issuing from the glacier.

The force of a burst is naturally proportioned to the cube of water suddenly set free. The volume of water discharged by the burst of Giétroz in 1818 has been estimated at 5,000,000 cubic metres (1,110,000,000 gallons); that of the bursts of the Crête Sèche in 1894 and 1898 at 1,000,000 cubic metres (220,000,000 gallons). In nine hours the Märjelen See, in 1878, evacuated 7,770,000 cubic metres (1,709,400,000 gallons).*

The passage of a flood of such dimensions, impelled in most cases by a very steep slope, naturally exerts erosive and transporting force on the ground over which it sweeps. The effects of such action have hitherto attracted little attention from geologists. The following statistics of glacial outbursts may, we hope, serve to show the importance and frequency of the phenomena, as also their bearing on the study of the Quaternary rocks.

The Alps.

I. *Outbursts caused by the Emptying of a Barrier Lake produced by a Temporary Glacier Variation in length.*

1. *Glacier of Rutor.*—Val d'Aosta. A northern branch of this glacier is liable to stop the overflow of a lake in the combe of the Osselettes, causing a considerable increase in its volume. Should the waters succeed in opening for themselves a passage under the bank blocking their normal outflow, a burst ensues.

From the end of the sixteenth century to 1752, not less than fifty outbursts were produced by the Lac des Osselettes. They corresponded with the periods of advance of the Rutor glacier. Trustworthy documents record outbursts in 1594, 1595, 1596, 1597, and 1598. According to Baretti, similar accidents occurred, in all probability, annually up to 1606. A second period of frequent floods began in 1629 or 1630 and lasted till 1646, a third from 1678 to 1680, and a fourth from 1738 to 1752. The great advance of the glacier during the first half of the nineteenth century did not produce any outburst. In 1864 the Lac des Osselettes, which was then of considerable extent, gradually wore for itself an outlet by the side of the glacier, and thus drained itself gradually without causing any disaster. After De Tillier ('Histoire du Duché d'Aoste,' 1738), the Lac des Osselettes had produced outbursts before 1594, of which the dates cannot be fixed.

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* According to the calculations of Prof. Baretti, the Lac des Osselettes, produced by the dam of the Rutor glacier, discharged during an outburst 4,500,000 cubic metres of water in six hours.

A document of 1752 records the "frightful devastations" caused by these floods in the valley of La Thuile and in the valley of Aosta. They washed away the fields bordering on the river-bed, covered them with heaps of matter, and threatened the destruction of Morgex (cf. M. Barretti, "Il lago del Rutor," in *Boll. Club Alpino Italiano*, No. 41, 1880, Torino). Every time they happen, the inundations act with erosive and transporting force.

2. In 1717 the *glacier of Triolet* gave occasion to a burst. This accident was caused by the rupture of the bank confining a lake formed of the accumulated waters derived from the glacier of Mont Dolent. The inundation, following an increase of the glacier of Triolet, covered a pasture-land with "immense *débris*." This mountain pasturage is said to have been afterwards invaded by the glacier (Virgilio, "sui recenti studii circa le variazione periodiche dei ghiaccaij," in *Boll. Club Alpino Italiano*, 1883).

3. *Glacier de Miage.*—This glacier, according to Baretti, must have several times choked up the Val Veni. Thence the possibility of bursts. In a memoir published in 1867, in the *Bollettino* of the Italian Alpine Club, Canon Carrel of Aosta mentions the occurrence of such accidents, but without assigning any date to them.

4. The *Gouille de Valsorey.*—This small sheet of water, situated on the flank of the glacier of Valsorey, which, owing to the decrease of the glaciers, disappeared in 1879, has given rise to bursts. De Saussure, who visited it in 1778, reports that it was remarkable for the ravages it caused. The mass of water, he says, sometimes empties itself in a few hours with terrific impetuosity, causing an overflow of the Dranse, carrying away rocks, and producing inundations and frightful devastations all the way from the glacier whence this torrent issues to the Rhône.

Sources of information for the Gouille de Valsorey are—

(1) 'The Alpine Guide. The Western Alps, by the late John Ball,' a new edition reconstructed and revised by W. A. B. Coolidge (Longmans: London, 1898), p. 437.

(2) 'Voyages dans les Alpes.' Edition 1786, ii. S. 1013, p. 466.

5. *Glacier of Giétroz.*—In 1595 and in 1818 an increase in the volume of this glacier *rémanié* caused the Val de Bagnes to be blocked up and a lake to be formed. The dam of water attained, in 1818, a length of 2100 metres (6888 English feet, or nearly 1⅓ mile), a breadth of 200 metres (656 feet), and a depth of 55 metres (180 feet). In the above-mentioned years of 1595 and 1818, the bank of ice suddenly gave way, and there ensued a frightful flood which swept over the Val de Bagnes and extended its ravages over the whole of the Lower Vallais. Escher von der Linth estimates the volume of water let loose in 1818 at 530 millions of cubic feet (Escher von der Linth, 'Notice sur la Catastrophe de Bagnes,' in *Bibliotheque universelle de Génève*, VIII. Sciences et Arts). At the bridge of Mauvoisin the waters rose to a height of 90 feet above the normal level of the stream, while the streets of Martigny were flooded to a height of 3·25 metres (10·66 English feet).

The inundation of 1595 destroyed five hundred houses and chalets. No less disastrous was that of 1818. The flood was deeply erosive. According to an account written by the Syndics of the Valley (cf. 'Echo des Alpes' (Génève, 1887), p. 350), it seems to have even produced a displacement of the great blocks disseminated in the valleys. Moreover, as usual in such cases, "it converted the fairest pasture lands into a plain of pebbles rising to a height of 2 to 20 feet above the current. It further deposited on the plain of the Rhône a thick layer of mud, casting on it an enormous quantity of wood from the forests and chalets devastated and wrecked in its course."

6. *Glacier of Crête Sèche.*—During the great glacial retreat characterizing the second half of the nineteenth century, the glaciers of Otemma and of Crête Sèche, which in the previous period of increase formed confluent currents in their lower course, separated and withdrew each into its respective valley. The Otemma glacier having, however, receded less rapidly than its neighbour, and having dropped across the whole breadth of their ancient common valley a pile of "dead glacier" * and of moraines, the waters issuing from the Crête Sèche glacier found their way blocked by this barrier, and so accumulated into a lake. From 1894 to 1898 the evacuation of this sheet of water caused two violent floods, one in 1894, the other in 1898, to leave out of account two more that were harmless.

The accident of 1898 drifted away heavy blocks of stone and covered with layers of detritus cultivated fields and pasture lands. Lastly, at Lourtier the Dranse, quitting the bed it had followed since 1818, scooped out a new one across arable lands, and excavated it to a depth of 12 metres (39·36 feet). This last burst discharged into the Rhône an enormous mass of sediment. Prof. Oettli calculates the amount of slime borne on this occasion by the Rhône into the Lake of Geneva at 166,000 cubic metres.

7. *The Glacier of Allalin.*—When in process of increase, this glacier completely blocks the outflow of the Mattmark See, and then the rupture of the dam causes floods. Accidents of this kind happened in 1633, 1680, 1740, and 1772. The flood of 1633, destroyed eighteen houses and carried away six thousand trees in the Saasthal. It is worth while to call attention to the fact that the glacier floods traversing wooded valleys sweep off considerable quantities of trees, and then drop them in masses in regions where diminution in the slope causes an abatement in the current.

8. *Zufallferner (in the Ortler District).*—From 1887 to 1891 this glacier, with the concurrence of the Langenferner, has given rise to four bursts. The great decrease in the volume of glaciers in the second half of the nineteenth century has brought about in the upper valley of the Plima a topographical situation analogous to that of the glaciers of Otemma and Crête Sèche. The Zufallferner and the Langenferner, formerly united at their lower extremity, separated. In the open space left between the two glaciers, the waters issuing from the Langenferner formed two lakelets that flowed away below the terminal tongue of the Zufallferner, a tongue traversing the principal valley.

The Zufallferner having increased, thanks to the slight augmentation occurring at the end of the nineteenth century, stopped the outflow of the lakes, and a large sheet of water was formed behind this barrier.

The rupture of this dam caused sudden evacuations of the basin. In 1887 there was a first burst of no importance; in 1888 a second of somewhat greater force; in 1889 a third which proved disastrous; in 1891 a fourth, equally destructive.

These inundations have brought about profound modifications in the valley of the Plima. The torrent has changed its bed in the centre of the village of Gand, and has strewn over the valley enormous quantities of blocks and of detritus. "The floor of the valley is a sea of rocks" ("Die Thalsohle ist ein Steinmeer"), reports the *Mitteilungen des Deutschen und Oesterreichischen Alpenvereins*, 1891, Nos. 12 and 13.

9. *Vernagt Glacier (Oetzthal).*—This glacier, in periods of advance, chokes up the Rofenthal and, blocking the waters issuing from the upper part of the valley, forms a lake. An occurrence of this kind happened from the spring of 1600 to September 9, 1601, from 1678 to 1683, from November, 1771, to 1774, and from May,

* *Dead glacier* is ice left behind by a retreating glacier, the melting of which is delayed by its heavy cloak of morainic material.

1845, to November, 1848. During these periods of stoppage, five terrible floods were produced; on July 20, 1600; July 16, 1678; June 14, 1845; May 28, 1847; and June 13, 1848.

In 1845 the Schlagintweits estimated the volume of the lake at 7·9 million cubic metres (1,738,000,000 gallons).

The rush of these enormous masses of water must have overturned all the Pleistocene formations in the Fendthal and Oetzthal. The destructive inundations made themselves felt as far as the valley of the Inn.

During the periods of the existence of the lake its basin has, on the other hand, been the seat of an important sedimentation. Prof. Hess has estimated the volume of matter deposited during the last stoppage at not less than 723,000 cubic metres.

A part of this matter has been carried away by the glaciers from 1845 to 1848, and the rest by the torrents, after they had resumed their normal course.

10. *Uebelthalferner.*—In periods of advance, this glacier chokes the Senner Eggenthal, and thus produces a lake and then glacier floods. Such an inundation occurred in 1847. Now, in consequence of the glacier's retreat, the opening of the Senner Eggenthal has been freed, and the lake has disappeared.

The great glacier extension which occurred in the Alps in the first half of the nineteenth century occasioned the formation of a great number of barrier lakes. Thus in 1817 the glacier of Zigiorenove threw itself across the Borgne, and thus caused the accumulation of a little sheet of water above the dam (Forel, "Les variations periodiques des glaciers des Alpes," VII[e] rapport, in *Jahr. d. S.A.C.*, xxii. 1866). In similar conditions the glacier of Trift has likewise given rise to a reservoir (*Jahr. d. S.A.C.*, ii. 1865, p. 61).

In any case, there is no doubt but that an exploration of the glaciers in Switzerland and in France * by scientists, and a search in the local archives, would bring to light a much greater number of such inundations than are at present known. So last summer Prof. P. Girardin discovered that during the first quarter of the nineteenth century, an advancing glacier of the valley of Champagny damned the torrent and formed a great lake. The rupture of the dam caused a terrible outburst. Traces of the lake and of the inundation are yet apparent.

II. *Floods caused by the Outflow of a Lake, independently of Glacier Variations.*

1. *Lac du Tacul:* Situated at the junction of the glaciers of Leschaux and Géant, at the northern base of the Pic de Tacul, this lake has occasioned floods at the lower extremity of the Mer de Glace ('Travels through the Alps,' by the late James Forbes. New edition revised and annotated by W. A. B. Coolidge, p. 85. London: A. & C. Black, 1900). On August 13, 1819, this Lac du Tacul gave rise to an inundation in the Valley of Chamonix (Delebecque, 'Les Lacs Français' (Paris, 1898), p. 250).

2. The *Gorner See* (not the tarn on the Gorner grat, but a pool at the base of Monte Rosa itself) causes by its evacuation an increase in the volume of the Visp. On August 23, 1900, the outflow of the lake poured into this torrent a flood of water which swept away a bridge and covered the fields with stones. The passage of this mass of water below the glacier must cleanse its bed of most of the detritus contained in it and carry it to the extremity of the glacier.

3. *Glacier of Hochbalmen.*—This glacier during the summer of 1755 gave rise

* Thanks to the late Prof. E. Richter's, of Graz, valuable book, 'Die Gletscher der Ostalpen,' on the Austrian alps, the local topography of the glaciers are better known than elsewhere.

to two floods caused by the discharge of a lake formed by it. These floods swept away a moraine and covered the cultivated lands with sand and rubbish ('Die Chronik des Thales Saas für die Thalbewohner, bearbeitet und herausgegeben von Peter Joseph Ruppen').

4. *Märjelen See.*—From 1813 to 1900, nineteen sudden evacuations of this lake under the Aletsch glacier have been recorded. In 1873 10,000,000 cubic metres (2,200,000,000 gallons) flowed away in eight hours. Such was the force of the torrent in boring itself a passage under the Aletsch glacier that jets of water burst forth through the openings of the crevasses. In 1878, 7,770,000 cubic metres (1,709,400,000 gallons) escaped in nine hours. It is evident that the passage of these masses of water must have to a considerable degree eroded the bed of the Aletsch glacier and the ravine of the Massa, the torrent issuing from its base.

5. *Glacier of Gurgl (Tyrol).*—The lake formed by the stoppage of the Langethal due to this glacier gave rise to a flood on June 30, 1717. Three hundred years previously, as reported by tradition, the Gurglerferner caused a formidable inundation brought about in the same way ('Forschungen zur deutschen Landes und Volkskunde,' vi. 4; E. Richter, 'Urkunden über die Ausbrüche der Vernagt und Gurglergletscher im 17 und 18 Jahrhundert.' Stuttgart: Engelhorn, 1892).

III. *Floods caused by Reservoirs situated on, under, or in the Glacier.*

1. *Glacier of La Rechasse (Savoy).*—In the night of September 5–6, 1899, the torrent escaping from this glacier suddenly deserted its usual mouth of outlet to issue thenceforth at a spot 300 metres (1000 feet) further off. It is impossible that the water can, in a single night, have scooped its way through a mass of ice 300 metres (1000 feet) thick. It is likely, therefore, that a network of sub-glacial passages existed at the lower extremity of the glacier of La Rechasse, and that no more was required than the rupture of one partition to divert the torrent into a new channel. This phenomenon was the reproduction on a small scale of that of St. Gervais. This hydrographic change has, of course, overthrown the moraines situated in front of the torrent's new mouth of outlet.

2. *Glacier de la Tête Rousse (Mont Blanc Chain).*—This little glacier, in the nights of July 11–12, 1892, sent forth a mass of water estimated at 200,000 cubic metres (440,000,000 gallons), producing the well-known terrible catastrophe of St. Gervais. The flood rushed with a mean speed of 50 kilometres (31 miles) an hour.

The burst widened the bed occupied by the torrent of Bionnassay, levelled part of the moraine of the Bionnassay glacier, carried away all the blocks it encountered on its passage, several of 200 cubic metres, and deposited the whole cargo, estimated at 1,000,000 cubic metres, either in the lower part of the valley of St. Gervais, where the slope diminished, or in the valley of the Arve by the village of Le Fayet.

3. *Glacier des Bossons.*—Every four or five years, according to the report of the inhabitants of Chamonix, the eastern part of this glacier gives rise to small bursts due to the outflow of sub-glacial reservoirs. On August 11, 1892, a relatively strong glacial flood was produced, which carried away a great mass of gravel and pebbles ('Ministère de l'Agriculture, Administration des Eaux et Fôrets; Exposition universelle internationale de 1900 à Paris; Les torrents glaciers,' per M. Kuss, Inspecteur des Eaux et Forêts, p. 42. Paris: Imprimerie Nationale, 1900).

4. *Glacier des Pelerins.*—According to the information which M. Henri Vallot was good enough to supply me, the small frozen sheet of water situated directly under the Aiguille du Midi and commanding Pierre Pointue gave rise to a little burst in 1898. The flood carried away the vegetation, laid bare the fixed rocks, and swept off trains of small stones and gravel.

5. *Glacier de la Neuvaz.*—On June 22, 1898, a small burst of no importance was caused by the outflow of a glacier-pocket pool. Its action, however, resulted only in the transport of sand and mud.

6. *Glacier of Festi.*—On August 1, 1899, the breach of a glacier-pocket pool caused a sudden swell in the torrent which, in consequence, carried away great blocks of stones (F. A. Forel, M. Lugeon, and E. Muret, "Les variations periodiques des glaciers des Alpes," XX^{e} rapport, 1899, in *Jahrb. d. S.A.C.*, xxxv. p. 215). In 1875 Sir Martin Conway witnessed a sudden swell of this torrent, connected, in all likelihood, with the evacuation of a glacier reservoir.

7. In 1899 *Zmutt glacier* set loose a flood capacious enough to cause at Sion a rise of 0·5 metre (1·64 foot) in the level of the Rhône (see authority last cited, p. 216).

8. *Glacier de Hohberg.*—On August 21, 1898, a pool of water in the interior of this glacier burst. The flood carried away a part of the moraine, swept off blocks of 50 to 60 cubic metres (*circa* 1760 to 2120 cubic feet), cut the railway from Visp to Zermatt at two points, and in both places covered the line with a layer of materials 2·5 metres (8·2 feet) deep, comprising blocks of 2 to 3 cubic metres (70 to 106 cubic feet) each (see authority previously cited, XIX^{e} rapport, 1898, in *Jahrb.* xxxiv.).

9. Every year the *glacier of Puntaiglas* (Tödi) swells the torrent it feeds. For twelve hours the waters continue to rise, making off with heavy materials. Thereafter they again subside.

10. *Schwenser Ferner* (*Oetzthal District*).—On July 9, 1891, the Schwenser Ferner gave rise to a flood, consequent on the evacuation of superficial cavities 35 to 40 metres (115 to 131 feet) long, and about 20 metres (65½ feet) broad. Inconsiderable mass of water though it was, it yet wrought great damage by reason of the rapidity of the slope down which it rushed. The Langgrubthal, a dale situated below the Schwenser Ferner, was covered with stones. The torrent, moreover, exerted erosive force on the banks and caused displacements. It further brought about changes in the disposition of its bed above Kurzhof (observations of Dr. Greim).

Besides the cases above enumerated, Alpine publications record various outbursts of water discharged by glaciers, the information about which is not sufficient to enable them to be traced to their causes. Thus in 1850, according to the testimony gathered by Prof. Forel (F. A. Forel, "Les Variations periodiques des Glaciers des Alpes," XIV^{e} rapport, 1893, in *Jahrb. d. S.A.C.*, xxix., 1894), the glacier of Tré-la-Tête appears to have given rise to a strong flood. In 1866 that of Macugnaga likewise caused an inundation, destroying a part of the moraine and covering the mountain pastures with enormous blocks of stone and with sand ("Excursion dal 1886 al 1868. Notizie dell ingegnere Felice Giordano," in *Boll. del C.A.I.* (Turin, 1868), 2 Sem. No. 13, p. 282). In 1892, again, the glacier of Weingarten on the Simplon likewise gave rise to a sudden rise in the torrent, which swept down an "enormous mass of materials" (F. A. Forel, as above cited, XIII^{e} rapport, 1892, in *Jahrb.* xxviii.) and destroyed the Simplon road and several chalets.

The number of floods produced by the outflow of glacier reservoirs is undoubtedly much greater than the list above adduced. It is only within the last ten years that these phenomena have been noticed. Moreover, as very frequently they devastate only the high pasture lands, they often escape attention and record.

Norway.

The great increase in the volume of Norwegian glaciers which prevailed in the first half of the eighteenth century, causing an advance on their part of 2 to 3

kilometres (1·24 to 1·86 English mile), must have given rise to numerous barrier-lakes, and consequently to frequent floods. The facts, however, have not been noted. We must therefore restrict our investigations to more recent inundations.

I. *Floods produced by Evacuation of Border or Barrier Lakes.*

1. In the Lyngenfjord chain the *glacier of Strupen* forms a border lake, similar to the Märjelen See, 1600 metres (5248 feet) according to some, 3000 metres (9840 feet) according to others, in length, and 800 metres (2624 feet) broad. On July 17, 1898, Messrs. Slingsby, Hastings, and Haskett-Smith discovered this basin, and found it full (W. Cecil Slingsby, "Mountaineering in Arctic Norway," in *Alp. J.*, May, 1899). A few days later it was found to be empty, the waters having run away under the glacier. This outflow must have produced in the lower valley, if not a flood, at least an inundation. Since, however, this lower valley is uninhabited, the event passed unobserved. Similar evacuations must happen frequently enough, as at the Märjelen See, causing erosions and transport of material.

2. The *glacier of Melkedal* (Jotunheim) blocks a lacustrine valley, open at its base, and separates Övre Melkedalsvand from Store Melkedalsvand. From time to time Övre Melkedalsvand breaks through the ice-dam and causes a burst. An accident of this nature happened in 1855 or 1856, in 1879, in 1894, and on August 11, 1901. The rush of water sweeps away all the land and vegetation in its course, and rolls down blocks as "large as houses."

3. The *Rembesdalskaak*, a branch of the Hardangerjökull, in the same manner as the Strupen, causes a border lake, and called the Dæmmevand. Whenever its evacuation is brought about suddenly, it produces floods in the lower valley, the Simodal. Such an occurrence happened in 1891, 1892, and 1893. The inundation of 1893 was particularly terrible. "Everything the torrent encountered on its course—bridges, trees, blocks of stones—were swept off and scattered in the valley. The trees along its line of route were torn up and borne away. Prairies and natural-grass lands were, in places, covered with great blocks. The Simodalsfjord, into which the torrent empties, became, it is said, so filled with floating wood that the mail steamer had to describe a semicircle round the obstruction, and was unable to put in at the entrance of the Simodal (Vibe, 'Söndre Bergenhus Amt.,' p. 244: Kristiania, 1896).

II. *Floods caused by Evacuation of Reservoirs situated on, or in the Interior of the Glacier.*

1. On July 1, 1904, in the district of Lunde, M.E.A. Martell saw an avalanche of ice fall from the upper portion of the Jostedalsbræ. Through the gaping hole left by the severance of the ice there burst forth an enormous waterspout. This is a conclusive proof of the existence of sub-glacial or glacier-pocket reservoirs (E. A. Martel, "Ruptures de poches d'eau des glaciers," in *La Nature*, Paris, No. of 25 Mars 1895).

2. In 1900 and 1903, the *Tunsbergdalsbræ* produced a great flood caused by the outflow of a sub-glacial lake. This sheet of water is formed under a tributary of the Tunsbergdalsbræ, the Store Brimkjedlebræ, at the junction of the two glaciers. It is probable that the bed of the Store Brimkjedlebræ presents a depression favouring the union of the waters. The formation of the lake is a consequence of the actual retreat of the glacier. The Store Brimkjedlebræ being no longer able to fill up the depression it formerly occupied, the void thus left by it is occupied by the waters in question.

The inundation of 1900 has caused a displacement of the junction of the

torrent (Tunsbergdalselv) with the main watercourse in the Jostedal valley, the junction being situated 15 kilometres (9 miles) from the glacier. The floods have done no more than transport mud and gravel (J. Rekstad, "Opdæmning ved Tunsbergdalsbræen, i Sogn," in *Naturen*, Bergen xxv., No. 3, March, 1901, and xxviii., No. 1, January, 1904).

III. *Floods the Causes of which are unknown.*

1. The *Kvalvikselv*, fed by the glaciers of the Ruksisvagge and of the Goalsse-vaggegaisse (Lyngenfjord), sometimes undergoes sudden swellings ('Beskrivelse af Tromsö Amt.,' p. 10: Christiania, 1870).

2. The glacier of *Vetlefjord* (Jostedalsbræ) gave rise in 1820 to a flood which overturned and scattered the moraines and destroyed the forests and dwelling-places in the valley. In 1868 the traces of this catastrophe were still discernible (C. de Sene, 'Le Névé de Jostedal,' p. 10: Christiana, 1870).

3. Towards 1830 the glacier of Kjærringbotn (Folgefond) discharged a flood of water which covered the banks of the torrent with gravel, sand, stones, and blocks of ice (Sexe, 'Om Snebræen Folgefond,' p. 15: Christiania, 1864).

4. In 1857 the *Buerbræ* (Folgefond) launched a similar mass of water (see authority last cited).

5. In 1893, the *Riingsbræ*, on the Horungtinder, was pierced at its lower extremity by a long tunnel. The natives ventured into this cavern to a distance of several hundred yards, when they were stopped by a deep body of water (W. Cecil Slingsby, "New Expeditions in 1894, Norway," in *Alp. J.*, No. 127, February, 1895). Perhaps it had given passage to an outburst.

ICELAND.

The glaciers of Iceland, the most extensive in Europe,* produce floods so terrible and so frequent that the Icelandic language has a special word, *jökulhlaupt* ("glacial outbreak"), to denote this phenomenon.

The "Jökulhlaupt" are the products of phenomena of two different kinds. Several Icelandic *ice-caps* are pierced by volcanic craters. When one of these volcanoes is in eruption, it dislocates the glacier, melts it, and causes the outflow of veritable deluges of ice, water, and blocks of stone. By the side of these "Jökulhlaupt" of volcanic origin, there are others of sufficient frequency, plainly of glacial origin, produced by the outflow of barrier or border lakes or glacier reservoirs. These floods, though less powerful than the volcanic Jökulhlaupt, are yet, in a singular degree, more important than those produced in the Alps. So frequent are such outbursts, that Sveinn Pálson, an Icelandic scientist, who observed very accurately the glaciers of Iceland from 1792 to 1794, names these floods ordinary jökulhlaupt, and the volcanic jökulhlaupt extraordinary jokulhlaupt.

Dr. Thoroddsen, the eminent Icelandic geologist, and the man most conversant with this island, enumerates the following glaciers as productive of glacial "jökulhlaupt":—

(1) *Solheima Jökull* (massif of the Myrdals Jökull). The floods are due to the outflow of a *Randsee* (or border-lake). They often occur several times in one summer. "The flood of water levels the moraines and transports their materials into the bed of the torrent, which sweeps off to the sea an enormous mass of gravel, drift-ice, and vast blocks" (Thoroddsen, "Rejse i Vester-Skaptafells Syssel paa Island i Sommeren 1893," in *Geogr. Tidsk.*, 1893–1894, xii. 7, p. 171).

* The most extensive glacier, the Vatnajökull, has an area of 8500 square kilometres (3281 square miles).

(2) The south-west branch of the Vatna Jökull, which feeds the Djupa, likewise gives rise to floods, consequent on the evacuation of a border-lake.

(3) A lake situated on the same glacier, at the foot of a *nunatak*, also produces inundations.

(4) The Skeidarar Jökull (south slope of the Vatna Jökull), when swelling, bars the courses of the Sula and the Nupsa, and causes the formation of barrier-lakes, and consequently of outbursts. In 1892 this glacier launched a frightful "jökulhlaupt," due, in the opinion of Thoroddsen, to the outflow of enormous masses of water contained in the interior of the glacier or on its surface. The flood wrenched considerable projections from the Skeidarar Jökull, and covered with drift-ice large spaces between the glacier and the sea. At one point these formed a barrier 7 kilometres (4·35 miles) broad. Many of the blocks had a height of 15 to 20 metres (49 to 65½ feet). This mass of ice, blackened with sand, gravel, and lumps of rock, looked like a lava torrent. The inundation affected a territory of 600 to 700 square kilometres (231 to 270 English square miles). Consequent on this burst, several watercourses changed their direction" (*vide* Thoroddsen, 'Rejse i Vester-Skaptafellsyssel,' p. 196).

(5) The Breidamerkur Jökull gives rise to barrier lakes, the sudden outflow of which produces floods.

(6) Another branch of the Breidamerkur Jökull, which feeds the Jökulsá da Breidamerkursandi, gives rise to "jokulhlaupt" (Sveinn Pálsson, "Försog Til en Physisk Geografisk, og Historiske Beskrivelse over de islandske Is-biœrge, I Anledning af en Reise til de fornemeste deraf i Aarene 1792 til 1794," in *Den Norske Turisforenings Aarbog* for 1882, p. 37: Kristiania).

(7) The eastern branch of the Heinabergs Jökull, barring a lateral valley, forms a lake, and, on the breaking through of the glacier dam, a flood. Near the torrent the sand shows circular cavities hollowed out by the melting of the blocks of ice carried away and stranded by the flood (Thoroddsen, "Fra det sydöstlige Island," in *Geogr. Tidsk.*, xiii., 1895–1896, 1 and 2, p. 8).

(8) On the north-east slope of the Vatna Jökull, the variations in length of the glaciers cause the formation of extensive barrier lakes, the evacuation of which is not brought about without floods (Thoroddsen, 'Islands Jökler i Fortid og Nutid,' p. 16, separate impression).

The whole area lying between the Vatna Jökull and the sea, as also the coast land to the south-east of the Myrdals Jökull, is composed of sand, in great part of glacial origin. The "Jökulhlaupt," passing through this territory of characteristically loose build, are incessantly overturning its soil. In one case, moreover, they hurl into the sea enormous masses of heavy material. These constitute the understratum of new deposits to be added to and built up by slow stages. The "Jökulhlaupt" are thus one of the most powerful agents in the formation of these lowlands.

Spitsbergen.

During the few weeks of the Arctic summer, from June 15 to August 15, the glaciers of Spitsbergen generally, but especially those in the western part of the archipelago, are subjected to intense fusion. As we are told by Sir Martin Conway and Prof. E. J. Garwood, the glaciers are furrowed by copious torrents, floating large masses of melting snow. There is accordingly a superabundance of water for the formation of barrier and border lakes, as also of numerous sub- and intra-glacier pools, which in emptying themselves give rise to floods. In the interest of the science of glaciers, the explorations of Sir Martin Conway and Prof. Garwood have therefore been specially important. On the Nordenskiöld glacier,

as also those in the neighbourhood of King's bay, these travellers encountered frequent border lakes and surface glacier pools, and have determined the effects of their floods. These effects consist mostly in the transport of glacial materials, their transformation, and their accumulation at certain points. Thus the outburst of a border lake on the King's glacier carried away into the ice-tunnel by which it emptied itself, rubbish and materials belonging to moraines. "The direction of this channel was at right angles to the main lie of the valley, so that, on the valley becoming free of ice as the climate ameliorated, this water-worn glacial material would be deposited as a gravelly ridge running roughly at right angles to the valley and forming a kame" ("Additional Notes on the Glacial Phenomena of Spitsbergen" in *Quart. Journal of the Geological Society*, November, 1879, lv. p. 686). This observation of Prof. Garwood's is very important, and should cast distrust on the method which consists in diagnosing the origin of Pleistocene substances according to their facies.

Greenland.

On the west coast of Greenland, up to 72° 25′ N. at least, the inland ice experiences, from the first half of June to the beginning of September, an ablation of the most intense kind, resulting in the formation of a very great number of glacial torrents and of glacier surface lakes. The surface of the inland ice is, so to say, cut up with watercourses, which leave between them hillocks of ice. It looks like an archipelago divided by a network of canals. The maps of the border of the inland ice, again, prepared by the Danish officers, show the frequency of border lakes in this region. All the conditions, therefore, are present for the production of frequent floods. If we hear but seldom any mention of this phenomenon in Greenland, the reason is that, the country being, so to say, a desert, such inundations mostly pass unobserved. The accounts of Danish explorers, who within the last twenty-five years have studied the western skirts of the inland ice, leave no doubt as to the frequency of this phenomenon. Jensen, for example, reports that the Tasersuak, barred by the ice of Frederikshaab, will produce outbreaks ('Meddelelser om Grönland,' i. p. 43: Copenhagen); how such floods are also produced by two lakes to the east of Godthaab (*ibid.*, viii. p. 88), and by a fourth basin situated on the inland ice to the east of Strömfjörd, 66–67° N. (*ibid.*, viii. p. 66). One day, reports this officer, Eskimos were hunting in a valley beneath the inland ice. Suddenly the torrent began to swell, inundating the valley and drowning one of the hunters. Another time the inundation of a torrent issuing from the inland ice, probably caused by the yielding of a glacier-barrier, carried away four oumiaks (Greenland boats), which their owners had drawn up on the dry land a long way from the river ('Meddelelser om Grönland,' i. p. 132). These accounts prove the existence of glacial floods in Greenland.

Alaska.

Hitherto no glacial outbreaks have been reported from Alaska, but that is no reason for assuming that none occur. In fact, the reservoirs necessary for the production of such inundations are very abundant in that region; barrier and border lakes, as also glacier lakes proper. One of the affluents of the Stikine river, for example, is obstructed by a glacier. After noting this topographic fact, Prof. Israel Russell adds that basins of water of this kind are common in the region lying farther to the north ("The Glaciers of North America," in the *Geogr. Journ.*, xii., December 6, 1898, p. 558). One of the branches of the Muir glacier forms a barrier-lake 6·5 kilometres (4 English miles) long and 600 metres (1968 English

feet) broad. Between the Chaix and Hitchcock hills and the Malaspina glacier are numerous border lakes. What happens in the glacier *massifs* of the rest of the world must likewise happen in Alaska—glacier floods. The lakes in Alaska empty themselves frequently, and in emptying themselves they cause glacier outbursts.

The Himalaya.

The high valleys of the Western Himalaya and the Karakoram are, as is well known, traversed by torrents of mud, called by the natives of Baltistan "shwas," and analogous to the torrential "lave" of the French foresters in the Alps. If in many cases these "shwas" are due to the dilution of glacial mud, encumbering the high Himalayan valleys, with the melting from the snow and ice, they are also very frequently produced by glacier outbreaks, properly so called. On this last point, all the explorers of the Kashmir glaciers—Colonel Godwin-Austen, Sir Martin Conway, and Prof. Norman Collie—are agreed. In these regions inundations produced by the outflow of glacier lakes are extremely frequent, and to be regarded, not as an accident, but rather as a normal occurrence.

I. *Floods caused by a Barrier-lake due to Glacier Variation.*

The high valleys of Kashmir are, in general, very narrow, and their lateral crests, from the great altitude they attain, are clad in extensive glaciers. As often, therefore, as the lateral glaciers make a rapid advance, they bar the principal valley, and there give rise to the formation of lakes, which, in turn, produce floods. Such is the situation in the case of the glacier of the Tashing, which in 1850 blocked the valley of Rupal (Norman Collie, 'Climbing in the Himalaya and other Mountain Ranges.' Edinburgh: Douglas, 1902). Such is equally the case with the great glacier of Biafo. This latter glacier, when in advance, closed the valley of Braldoh, and led to the formation of a barrier-lake of "several miles long," the sudden outflow from which produced a terrible flood. It was to an inundation of this kind, in all likelihood, that was due the destruction of a village reported by local tradition. The inhabitants, when relating the event to Godwin-Austen in 1861, referred its date to two centuries before that time.

II. *Floods caused by Lakes independent of Glacier Variations and by Glacier Lakes.*

The great glaciers of the Karakoram—the Baltoro, Biafo, Hispar, etc.—are, together with the Seward of Alaska, the greatest ice-streams of the Alpine type at present in existence. These enormous streams, 50 to 68 kilometres (31 to 42 miles) long, have a very gentle slope, averaging 3·5°. The lower limit of the *névés* is accordingly found at a very great altitude, 5700–5800 metres (18,696–19,024 English feet) on the Baltoro in 1902 (Dr. Jacob Guillarmod, 'Six mois dans l'Himalaya.' Sandoz, Neuchâtel). A vast surface of ice thus lies exposed to fusion, a fusion all the more intense inasmuch as the climate is very hot. During his stay of nine weeks on the Baltoro, Dr. Jacob Guillarmod found the daily maximums invariably above 32° Fahr., and frequently saw the thermometer mount to 68° Fahr., as also four times to 95° Fahr. Under these conditions, the melting is very rapid, and consequently the glaciers of the Karakoram are furrowed by numerous and powerful torrents, while beside their banks flow copious water-courses. These rivers give rise to numerous border and glacier surface lakes.

On the Hispar, Sir Martin Conway reports frequent surface sheets of water. On the glacier of Punmah, Godwin-Austen encountered several surface glacier lakes, and also border lakes. In 1861 the Baltoro comprised numerous surface

basins 450 metres (1476 English feet) long by 60 to 90 metres (196 to 295 English feet) broad. On the passage of the Conway Expedition of 1892, these bodies of water were no less abundant than in 1861. In 1902, Dr. Jacob Guillarmod record the presence of frequent border and glacier surface lakes. The phenomenon is therefore a constant occurrence on this glacier.

It appears that the great glaciers enclose, besides, glacier pocket reservoirs. Twenty-two kilometres (13½ English miles) from the front of the Baltoro, M. Guillarmod found a basin of considerable dimensions, which had emptied itself by a fissure at the bottom. On one side of this basin there opened, in the thickness of the glacier, a cavity more than 30 metres (98 English feet) deep, which no doubt served as bed of an intra-glacier torrent.

Colonel Godwin-Austen noticed that the glacier surface cisterns often emptied themselves in a night, and then filled again very rapidly from the contributions of numerous inter-glacier drains. On the sides of these cisterns, he relates, are little holes, through which the water runs out as through so many taps.

On the glacier of Biafo, again, Mrs. F. Bullock Workman reports irregular openings, the diameter of which does not exceed the breadth of a human head, leading to profound abysses.

All these border and glacier lakes empty themselves at irregular intervals. The arrival of the floods of water at the lower extremities of the glaciers is a signal for the issue of torrents of mud. In the environs of the village of Tisir, in the valley of Basha, Godwin-Austen saw the fields covered with sand, detritus, and great blocks of stone, eight or ten houses buried, and great trees overturned. The disaster was the effect, so the natives told him, of a flood caused by the sudden evacuation of a glacier lake. Whoever has not witnessed one of these floods, writes this admirable observer of glaciers, can form no idea of the transporting power of those masses of water and melting snow.

The floods level the moraines, sweep away their materials, push before and with them all the blocks of stone they encounter, and carry off an enormous mass of mud. There is no need, however, to exaggerate the power of these phenomena. Their effects are strictly limited to the valley bottoms. Godwin-Austen estimates the breadth of the "shwa" he witnessed at 27 metres (88·58 English feet), and its depth at 4·5 metres (14·76 English feet). Conway reckoned the "shwa" he witnessed at 12 metres (39·37 feet) broad.

This long catalogue may show that glacial outbursts are produced in all regions covered with glaciers, and that their frequency is proportioned to the extent of the glaciers. In the Alps, where glacial phenomena are reduced to a very small compass in comparison with their development in the Karakoram, Alaska, Spitsbergen, and Greenland, no less than nineteen such outbursts have been duly authenticated since 1890.

These inundations exert considerable erosive power, modify markedly the line of the valley bottoms they follow, in the way both of enlargement and of displacement. They also exert important transporting force, displacing great blocks and carrying away enormous masses of mobile material, which they accumulate at the mouths of glens opening into the principal valley, and at points where the slope suddenly lightens. Consequently, in the valleys subject to these phenomena the actual glacial formations are transported to a distance, and receive a new facies, while the Pleistocene deposits are refashioned throughout the whole zone touched by the inundation. It has to be further observed that the floods destroy the forests they overtake, and deposit enormous quantities of wood on the places where they stop or lose velocity. The catastrophe of Giétroz in 1818, for example, floated

into the valley of the Rhône vast masses of wood. A part of it was derived from the destruction of a great number of chalets. The inter-glacial lignites might be traced to this origin.

The action of bursts may be compared to that of the shoots of water artificially produced in some of the ports on the French coast of the English Channel, in order to clear their entrances of pebbly obstructions and throw them back into the deep sea.

These inundations must have been produced in the Glacial period under the same conditions as to-day in Greenland and other Arctic regions. This being incontestible, it is in our opinion proper to observe a very great reserve in determining the origin of the Quaternary formations. In a number of cases geologists are certainly in error in attributing exclusively to glaciers formations which are the combined product of glaciers and of running waters. The "fluvio-glaciaires" deposits cover a greater surface than "formations glaciaires" properly so called. The part played by floods issuing from glaciers has hitherto been too much neglected. Now, in our opinion the part played by such waters is considerable. The water circulating under the glacier is charged with mineral particles. It is thus a particularly active agent of erosion. When it runs in a broad bed, the water acts as a polisher; perhaps many *roches moutonnées* result from this effect of the glacial waters; when enclosed in a ravine, it acts as a saw; lastly, when a great flood of water is produced, it transports to a distance materials supplied to it by the glacier, and with these materials it fills all the depressions it meets.

We must not, however, go from one extreme to another, and we must guard against exaggerating the effects of glacial outbursts. In the present epoch they affect only the banks of the river-beds and the lower parts of the valleys; during the Quarternary period their power was also limited to the valley bottoms they followed.

NOTE.

By Douglas W. Freshfield.

M. Charles Rabot's article, and the copious statistics with which it is accompanied, will, I trust, fulfil his object by attracting the attention of glaciologists, geologists, and travellers to the class of catastrophes which he describes. Heim has well compared a glacier to a sledge, which, picking up the heavy burden entrusted to it by the forces that split the mountain cliffs, carries down its load slowly to the valleys. We may, perhaps, compare these torrential outbursts to a motor car, which, catching up a portion of the packages, whirls off with them to the spot where the diminution of the slope puts an end, if not to its own progress, to its carrying power. I tread with trembling on the confines of geology, but I shall hardly be wrong in endorsing M. Rabot's argument that the effects of these outbursts in past times of more extensive glaciation in the Alps must have been on a scale vastly in excess of what we witness to-day, and that sufficient attention has not hitherto been paid to them as agents in earth-sculpture. Is it not possible that a certain number of the more lowlying so-called "erratic blocks" may have been caught up by these floods and carried to their present positions? The suggestion seems at least worth considering. I should further like to point out the undesigned coincidence of M. Rabot's reference to the saw-like action of subglacial torrents with a passage in my address, printed in the October number of the *Journal*.

I am unwilling to add to the length of M. Rabot's valuable and suggestive paper. I will, therefore, only mention here, without going further into detail, the two very important catastrophes recorded in recent times in the Caucasus: the periodical outbursts proceeding from the Devdoraki glacier under Kasbek

in the middle of the last century, which on more than one occasion destroyed the Dariel road, and the great flood of the torrent of the Gezel Don glacier in the same district in 1892. In the Sikhim Himalaya under Kangchenjunga I did not discern any traces of changes brought about by the sudden collapse of lakes, the origin of which was due, in one way or another, to glacial action. There was no scarcity of glacial surface lakes and barrier lakes, but, owing partly perhaps to the warmth and perennial rainfall, they appear to drain themselves in a less spasmodic manner.

THE INDIAN EARTHQUAKE.

On April 4 a severe shock of earthquake visited northern India, doing an immense amount of damage, principally at Lahore, Mussuri, and Dharmsala, and causing a lamentable loss of life. At Lahore the cathedral was seriously damaged, as well as the Juma Masjid, one of the finest mosques in India, and many other buildings, both public and private. Some loss of life occurred here, but this was far exceeded at Dharmsala, where both the cantonment and civil station were practically destroyed, many Europeans being among the victims. Owing to the collapse of the stone-built barracks, the Gurkha regiments, especially the 7th Gurkhas, suffered terribly, no fewer than 470 in all being killed. At Kangra three European missionaries were among the victims. Other places at which damage was done were Delhi, Amritsar, Dehra Dun, Amballa, Simla, and Srinagar, though at none of these was the loss of life exceptionally high. The disastrous shocks, which seem to have been repeated several times, occurred in the early morning of the 4th, but further slight shocks are said to have been felt during the following night.

The following remarks are made by Mr. R. D. Oldham:—

The telegraphic reports enable us to form an approximate idea of the magnitude of the earthquake. It undoubtedly ranks as a great earthquake, whose violence exceeded 10 degrees—the maximum of the accepted scales of earthquake classification—over a considerable area, but it was far from coming up to that of 1897 either in extent or violence. It is too soon to form an estimate of the latter, but the extent of country over which it was felt cannot have been more than one-quarter of that affected in 1897, though the death rate was probably more than four times as great. The focus evidently lay in the Kangra valley, or between it and the Dhaoladhar range, but, if newspaper accounts are to be trusted, the shock seems to have been more violent at Mussuri than would have been anticipated, and this suggests the possibility that it originated in a movement along the great boundary fault of the Himalayas; it will be interesting if the investigation, which we may trust the Indian Government to make, should establish a renewal of movement along this great structural feature which has played an important part in the elevation of the Himalaya.

The following comments on the earthquake have been sent by Dr. Charles Davison:—

At or shortly after 6 a.m. on April 4 North-West India was visited by one of those great earthquakes which not only devastate extensive areas, but give rise to undulations that are recorded by seismographs in every part of the globe. During the previous night two slight shocks were felt at Mussuri, and probably also at other places; but the great earthquake itself occurred so suddenly and with so little warning that most of those indoors were unable to escape. The position of the epicentral district is still unknown, but it probably includes the towns of Dharmsala, Kangra, and Palampur, which are situated about 160 or 170 miles

east-north-east of Lahore. At these and several other places the destruction of buildings was practically complete, and the loss of life very considerable, though fortunately less than was at first supposed. That the number of persons killed must amount to several thousand there can, however, be little doubt.

The area within which buildings were damaged is of unusual extent. To the north, west, and south it includes Srinagar, Rawul Pindi, Lahore, Ferozpore, Patiala, and Dehra Dun. Even so far to the south as Delhi many buildings were injured, though without any accompanying loss of life. Towards the east the boundary of the area of destruction is still undefined; but if, as is probable, Dharmsala lies near the epicentre, it must pass not far from Leh, in Laduk. Bearing in mind the uncertainty of our data, a first estimate would give about 520 miles for the length, 360 miles for the width, and 150,000 square miles for the area of the region within which serious damage occurred to buildings and property.

Still more uncertain is the extent of the total area disturbed. For about half its course the boundary of this area traverses countries from which all observations of scientific value will be found wanting. It is reported, but the report requires confirmation, that the shock was felt very slightly at both Bombay and Calcutta, the former of which is about 980 and the latter about 1020 miles from Dharmsala. If we take the latter figure for the radius of the disturbed area, the total region over which the shock was sensible must have been about 3¼ million square miles, or not much less than the area of Europe.

In its great duration, the recent earthquake resembled other shocks of the first magnitude. At Mussuri it lasted quite three minutes, though one estimate is as low as one and three-quarters, and another as high as five minutes. Possibly the originating movements were not uninterrupted, and in times of terror all estimates are liable to exaggeration; but hardly any feature of the shock bears such eloquent testimony as this unusual duration to the vastness of the seismic focus or the magnitude of the forces that are capable of giving an impulsive thrust to so large a portion of the Earth's crust.

To suggest any definite cause as the origin of the earthquake may be at present premature. But one fact worthy of notice is the elongation of the area of great destruction in the direction of the Himalayan axis. This seems to point to an intimate connection between the earthquake and the growth of these ranges, either by a series of fault-slips, or, as Mr. Oldham suggested for the Indian earthquake of 1897, by a slide forward along a thrust-plane, accompanied by secondary, but by no means unimportant, slips along the faults that branch up towards the surface.*

REVIEWS.

EUROPE.

City Development.

'City Development.' By Patrick Geddes. Edinburgh: Geddes & Co. 1904. *With Plan, Perspective, and* 136 *Illustrations.*

This finely illustrated volume embodies the suggestions made by Prof. Patrick Geddes to the Dunfermline Carnegie Trust for the beautification of the city and the promotion of its civic usefulness. Taking his stand, as a geographer, on the natural features of Dunfermline, "the fort on the crooked water," the author shows how many of these, and particularly the "crooked water" itself, with its

* We hope to publish in the June *Journal* a reproduction of Dr. Davison's record of the earthquake.

glen, could be made to contribute in the most striking manner to the beauty and special character of the city. His scheme further includes the laying out of a spacious park, with botanic and zoological gardens, lawns, and shady alleys, formal gardens and wild gardens, orangeries and pine woods, as well as vistas and avenues framing the beautiful architectural perspectives which the city offers.

As a promoter of city improvements, Prof. Geddes is known to be both conservative and courageous. He "would respect and preserve examples of honest and characteristic work of each and every period, whether from our present point of view it seems beautiful or not." Each survival of the past is consequently to be looked at as an actual or possible asset. This method is admirably illustrated by a remarkable series of pairs of photographs, one of which shows a portion of Old Dunfermline in its present neglected condition, while the other, by a skilful process of retouching, shows how it may, without destroying any of its essential features, be modified into a harmonious whole.

Among the most interesting features of a book to whose suggestiveness in many directions no justice can be done within the limits of a brief notice, is the proposal for a series of culture institutes which shall express the many sides of complete civic life. These would include, not merely the conventional library, picture gallery, and scientific museum, but nature museums, labour museums, open-air museums, historical institutes, and art institutes, all expressing in their structure those synthetic ideals which Prof. Geddes has long striven to popularize, while another group of social institutes would emphasize the needs of man, woman, and child in their individual, as well as in their corporate capacity. Into the vistas which these open out it would be rash to enter, but in the *Geographical Journal* attention may fitly be called to the nature palace of geography. Here are gradually to be collected and properly oriented a series of typical landscapes or panoramas similar to those which delighted so many visitors to the last Paris Exhibition.

"The visitor, entering at the north and keeping his left hand to the east, so as to travel with the sun, would thus pass through the characteristic landscapes of the Old World. He would begin, say, with Nansen's ancient ice; pass to Lapland, with its Lapps and reindeer; descend to the pine forests of Norway, with its sturdy woodman, its boat-builder on the fiord; thence through Denmark or North Germany to the alpine landscape; thence again to Italy, to South Italy or Greece, to Asia Minor or Syria. A series might lead through Mesopotamia, Persia, the Himalayas, and India to Ceylon; another through Manchuria, Korea, and Japan, through China, Burma, and the Malay peninsula; yet another to and through Australia and New Zealand. Or, coming down again from the north upon the western hand, he would similarly start with a Greenland or Alaskan glacier and the Eskimo encampment at its foot, and pass, by a Canadian forest and lake scene with its half-breed trapper, to the vast wheatfields and orchards of Manitoba, or the apple orchards around Quebec. From a farm scene of New England he would pass to the cotton and tobacco plantations of the Southern States, and thence again to the great swamps of Florida, or the orange groves and ranches of California, and once more to the gorgeous cañon architecture of the Yosemite, to the mighty trees and the cactus desert."

Similar series are planned to illustrate the other regions of the world, while a great globe, showing the physical features in relief, would help to correlate these varied impressions. With such a graphic representation of the wonders of the world, one can imagine Dunfermline becoming the Mecca of the geographical teachers of many lands.

At a time when many cities, and notably London, are paying by costly schemes

of rebuilding for the fortuitous methods of expansion permitted in the past, such a book has a special interest. Those who attended the economic section of the Cambridge Meeting of the British Association will remember that plans were exhibited, which had been prepared for reference by German cities, many years in advance, to secure expansion along lines at once beautiful and hygienic. Prof. Geddes is, we believe, the first to attempt to do the same for any city in this country, and whether readers agree with his detailed suggestions or not, few will deny that such surveys, by men of wide culture and experience, are necessary if our rapidly growing towns are to expand into dignity and beauty instead of into chaos and slumdom.

ASIA.

The Literature of the Mission to Lhasa.

'Lhasa.' By Perceval Landon. 2 vols. London: Hurst & Blackett. 1905. *Maps and Illustrations. Price* 42*s. net.*

'Lhasa and its Mysteries.' By Colonel L. A. Waddell. London: Murray. 1905. *Maps and Illustrations. Price* 25*s. net.*

'The Unveiling of Lhasa.' By E. Candler. London: E. Arnold. 1905. *Map and Illustrations. Price* 15*s. net.*

'To Lhasa at Last.' By Powell Millington. London: Smith, Elder. 1905. *Price* 3*s.* 6*d. net.*

The future historian of the twentieth century will suffer from no lack of material in compiling his chapter on the British Mission to Tibet of 1903–4. Two substantial Bluebooks provide much curious geographical and diplomatic matter. In addition to these four works, two of them substantial in size, have already been issued by eye-witnesses of the campaign. It may be convenient here to notice them together.

The more important volumes are those of Mr. Landon, who was the *Times* correspondent with the Mission, and Colonel Waddell of the Army Medical Service, the author of 'Among the Himalaya,' who by long study and travel has made himself a master of the Tibetan language and literature, and an authority on Buddhistic lore and ritual.

There is inevitably a good deal of repetition in the several volumes, as regards the events of the campaign and the scenery and buildings described. Both writers give in detail the incidents of the march, of the sieges, first of our own force and then of the Tibetans, at Gyangtse, and of the protracted negotiations at Lhasa. Yet they supplement one another in many particulars, for they observe from different points of view.

To Mr. Landon the reader will go for a consecutive history of the expedition and the affairs which led up to and concluded it. For, having no fear of the censorship of superior officials before his eyes, he can comment on as well as describe the conduct of the Mission with a freedom denied to those engaged in Government service. And he saw somewhat more of the fighting than his fellow-authors, as he alone was present at the first battle on the Karo La. Both writers make clear that the slender force left at Gyangtse while this operation was undertaken had a very narrow escape from annihilation, and that the Tibetans laid a trap which, with a little more determination on their part in the night assault, might easily have proved fatal to Sir Frank Younghusband and his escort.

To Colonel Waddell the student will naturally turn by preference for accounts of the political institutions of Tibet, for interesting interviews with its priests and statesmen, for the comments of an expert on the religion and customs of the

country, for the translations of local names—the Tibetans set us an example in picturesque nomenclature—and last, but not least, for the collection of Tibetan proverbs with which he has headed his chapters. Here is a specimen, "It is no use trying to tug the glacier backwards."

In his descriptions of scenery and buildings Mr. Landon has been at pains to supply and emphasize local colour, to convey to his readers vividly and precisely his own impressions of the strange sights of the road. He has an excellent eye for nature, and a considerable talent for reproducing effectively picturesque detail both in landscape and architecture. Nor is similar praise to be denied to Colonel Waddell, though in some instances his sentences show signs of hurried composition. Colonel Waddell sees a Tibetan temple with the eyes of a Buddhistic scholar, Mr. Landon with those of a decorative artist. As a rule, their accounts coincide with or supplement one another. But in one instance at least, and that an important one, their impressions of the famous Buddha of the inner sanctuary of the Jokang, or great temple of Lhasa, they are in amusingly direct contradiction. And in his account of the interior of the Potala palace, Colonel Waddell is the fuller and the more appreciative. It will be obvious that readers seriously interested in Tibet should study both works. The passages quoted below may show that the labour will not be increased by any lack of literary skill on the part of their authors. The following is Colonel Waddell's description of the "suburbs of Gyangtse in spring," which may help to dispose of "the fallacy that Tibet is a vast hilly and barren country, peopled by roving pastoral tribes."

"It was a perfect spring morning. All nature was vibrating with the joy of new-found life. The frost-bitten land had thawed under the few weeks' genial sun, and through the soft soil by the roadside and on the borders of the fields fresh green shoots were pushing themselves up alongside deep-olive beds of exquisite pale-blue iris lilies, and pink clumps of dwarf primulas and gay saxifrage which already begemmed the ground amongst the golden gorse bushes. From every hamlet the cottagers had swarmed out into their fields, and were busily ploughing and sowing in the glorious sunshine, forming pleasing bits of bright colour. The men were ploughing with oxen gaudily bedecked with plumes of wool, dyed glowing scarlet and blue, with long throat-tassels of dyed yak's-tails and harness of jingling bells, while close behind the ploughers came the gaily dressed women as the sowers, scattering broadcast the seed from their baskets. Most of them, men and women, were humming snatches of song in light-heartedness, or in pleasing vision of the new season's crops. Amongst the tall poplar trees embedding the homesteads, neatly picked out with red ochre and whitewash, and among the pollarded willow bushes fringing the irrigation canals, flitted rosefinches, fieldfares, hoopoes, pert tits, cinnamon sparrows, shy doves, warblers, and thrushes, all blithely pairing and nest-building; and beyond in the fields real English larks were singing skyward above the chirpy red-legged crows and foraging ravens. Occasionally flocks of sandgrouse sped swiftly past us, and a few wild duck and geese, scaring the partridge and hares from their cover, or the terns from their trout-fishing whirred noisily down amongst the reedy hummocks fringing the turquoise pools on the river where they breed."

With this idyllic picture may be coupled Mr. Landon's description of the approach to Lhasa. He writes—

"There was nothing, less, perhaps, in such maps and descriptions of Lhasa as we had than anywhere else, to promise us this city of gigantic palace and golden roof, these wild stretches of woodland, these acres of close-cropped grazing land and marshy grass, ringed and delimited by high trees or lazy streamlets of brown transparent water, over which the branches almost met. . . . Between and over

the glades and woodlands the city of Lhasa itself peeps, an adobe stretch of narrow streets and flat-topped houses, crowned here and there with a blaze of golden roofs or gilded cupolas. But there is no time to look at this: a man can have no eye for anything but the huge upstanding mass of the Potala palace to his left; it draws the eye of the mind like a lodestone, for, indeed, sheer bulk and magnificent audacity could do no more in architecture than they have done in this huge palace temple of the Grand Lama. Simplicity has wrought a marvel in stone 900 feet in length and towering 70 feet higher than the golden cross of St. Paul's Cathedral."

Both books are lavishly illustrated and supplied with valuable maps and plans. But it is obvious that colour is required to do full justice to Tibet, and Colonel Waddell's three-colour photographs and Mr. Landon's reproduced sketches make us somewhat discontented with the monotony of black-and-white plates, effective enough for buildings or figure-subjects, but too small to give the scale of Himalayan scenery.

Mr. Candler's volume is in the main a spirited narrative of the incidents of the march. By his own showing, the author was more interested in the human side of the adventure than in the "sights" of Lhasa. He has succeeded, however, in giving just the sort of information the average reader, who seeks for entertainment rather than instruction, asks for, the first-hand impressions of an eye-witness who, whenever his interest is roused and his intelligence excited, knows how to describe as well as to observe.

The fourth book, Mr. Millington's, is on a very small scale: his interests were mostly confined to the branch of the service, the transport, to which he belongs; and he has amused himself by adopting the camp slang and the traditional attitude of the British official towards general or scientific knowledge. Still, we thank him for a forcible summary of the advantages of Chumbi, some notes on the effects of altitude, and a graphic account of the mode of requisitioning provisions at a Tibetan monastery.

What are the chief additions to our geographical knowledge recorded in these volumes? In the first place, the route to Lhasa has been surveyed and mapped, together with much of the country along the frontier from Khambajong eastwards. Lhasa itself has been described, mapped, and illustrated, so that it is now as familiar as any European capital to the untravelled public. The popular conception of Tibet has been profoundly modified and corrected.

Readers of this journal will have been prepared to hear that it was not found to be the pathless and inhospitable frozen desert that had loomed in the vision of certain writers. But the descriptions, from which we have quoted, of the vale of Lhasa as an Arcadia, of its orchards and cornfields, its gardens and homelike wild flowers, as well as those of the city itself (Colonel Waddell goes so far as to style it "one of the most delightful residential places in the world"), will come on most of us as a surprise. The agricultural wealth of the country is considerable, and its pastoral resources seem to be large and capable of development. It should further be borne in mind that the still unexplored eastern Tibet, the valley of the Sangpo below the Choksam ferry, is reported to be a still more fertile and thickly inhabited region than that which charmed our soldiers. We have gained also full evidence as to the character of the valley of Chumbi, which has by accident become politically Tibetan while geographically and ethnologically appurtenant to the Cis-Himalayan states. On all the following points there is absolute agreement between our authors. Chumbi proves to be a Himalayan Oberland, the natural sanatorium for Calcutta and Bengal, standing to Darjiling in this respect in the relation the Engadine does to Monte Generoso. It has every qualification for a military station,

since it commands the main road to Tibet, and offers good camping-ground in a relatively dry climate, whereas troops at Darjiling are damped by excessive rains, and have to descend 6000 feet from their isolated hilltop in order to get anywhere. Chumbi is also obviously the natural site for our chief Tibetan trade mart. It seems hardly credible that the time will not soon come when it will be recognized that the only treaty which might have given the Tibetans a title to this valley never came into operation, and that there is no adequate political reason why it should not be made use of.

On a subject important to future explorers of the Himalaya—the effects of altitude on the human frame—a large amount of fresh experience has been collected. It all goes to confirm the experience of recent mountaineers, that the violent indisposition often felt on reaching heights of 12,000 to 15,000 feet tends to disappear on further advance after a short interval. It has been proved that at 20,000 feet many men can climb and carry burdens and even fight without serious suffering, though they will be handicapped by the altitude much as they would be at sea-level by a burden. It is, indeed, stated by Colonel Waddell that the Tibetans in their flight from the Karola crossed snowfields at a height of 23,000 feet. The incredulity that was freely expressed in India some twenty years ago as to the possibility of attaining such altitudes at all is now quite out of date. But the highest part of the battlefield being estimated at 19,000 feet, it is, to say the least, strange that fugitives should have climbed 4000 feet more, and it seems possible a three may have slipped into the place of a nought. The point is worth clearing up. The following observation of Colonel Waddell's is probably novel: "One curious result of the cold should be mentioned here, namely, its effect upon the speech of the people. A peculiarity of the language of the Tibetans, in common with the Russians and most arctic nations, is the remarkably few vowels in their words, and the extraordinary large number of consonants; for example, the Tibetan name for Sikhim is 'Hbrasljongs.' Indeed, so full of consonants are Tibetan words, that most of them could be articulated with almost semi-closed mouth, evidently from the enforced necessity to keep the lips closed as far as possible against the cutting cold when speaking."

To the remaining aftermath of the mission, the discoveries of the exploring party that has passed through Gartok to Simla, and the far more important expedition, postponed last year, but it may be hoped not indefinitely, to Eastern Tibet and the gorges of the Sangpo, we have, of course, only allusions in these works. But Colonel Waddell has been able to give, from native sources, some interesting information as to the latter district, and a Tibetan picture of the legendary falls of the Sangpo.

An appendix by Captain O'Connor to Mr. Landon's work, dealing with "the present condition and government of Tibet," is well worth perusal.

D. W. F.

AFRICA.

East Africa and its Animal Life.

'In Unknown Africa.' By Major P. H. G. Powell-Cotton. London: Hurst & Blackett. 1904. *Price* 21*s*.

'Mit Blitzlicht und Büchse.' By C. G. Schillings. Leipzig: R. Voigtländer. 1905.

Major Powell-Cotton has rendered signal services to the zoological collections of Great Britain, and to our knowledge of the life-habits and distribution of rare and interesting African mammals. It was he who obtained the first good specimens of the rare Abyssinian ibex for our national collections. He heard that the writer of this review had brought home from the country east of Mount Elgon three heads of the five-horned giraffe, and was anxious to proceed to those regions

of eastern equatorial Africa to substantiate this discovery, and, if possible, to procure complete specimens of this giraffine type. Difficulties of transport had prevented the present writer from bringing to London more than the heads and necks of three of the aforesaid giraffes, and, as one of these was a female without the extra pair of horns, naturalists were undecided as to whether the specimens constituted the type of a new variety or sub-species, or whether they were simply "sports."

Major Cotton amply confirmed this discovery, and the complete specimen of the five-horned or Baringo giraffe now in the Natural History Museum is due to his enterprise.

But the book under review is also the outcome of this expedition. It is a work which is more suited for review by the Zoological than by the Royal Geographical Society, since its main interest lies in its notes, photographs, and descriptions of the big game of eastern equatorial Africa, especially the region between Kilimanjaro on the south and the White Nile on the north, including the hitherto very little-known northern districts of the Uganda protectorate, north of Mount Elgon and west of Lake Rudolf. Yet from a geographical point of view also Major Powell-Cotton's journey is a remarkable one. He covered a little new ground north of the explorations made by Macdonald and Austin, and south and west of the journeys of Wellby and Donaldson-Smith. He has brought us back a good deal of information about that mountain of beautiful outline, Debasien, immediately to the north of Mount Elgon; and also concerning the western part of the Turkana country (with its mountains reaching to altitudes of over 10,000 feet), and the very little-known country of the Dodinga hills.

Major Cotton writes with some bitterness regarding the difficulties he met with on landing at Mombasa from the minor officials of the East Africa protectorate (in relation to the passing of his baggage, customs duties, etc.). He also is indignant at the want of encouragement given to him to obtain specimens of certain animals from the Reserves, and the slowness with which permission was granted to him to shoot animals placed on the "wholly protected" list. With regard to the first count of the indictment, there is no doubt that the complaint is well founded. Some special microbe must exist at Mombasa which makes the British officials there more unsympathetic and obstructive to the tourist than such persons generally are. Even the writer of this review, though himself an official at the time of his recent journeys in East Africa, had to complain of the delays which were placed in the way of passing his baggage through the customs house. But it is difficult to say whether either the Museum authorities in London, the Foreign Office, or the protectorate authorities in East Africa were to blame regarding the slowness with which the special permits were granted to Major Powell-Cotton. We all know him now, and the evidence of his discrimination as a naturalist and his remarkable public-spirited generosity may be seen by every one at the Natural History Museum, South Kensington. But when he was starting on his great journey through eastern equatorial Africa in 1902 his character and intentions were not so fully known as perhaps to warrant the authorities in according to him without hesitation the right to infringe the rules and regulations in force relative to the preservation of big game. It has grown to be the practice of every sportsman who wishes to visit the British protectorates in Eastern or Central Africa to ask for special facilities in regard to the killing of protected animals or shooting within game reserves. In nine cases out of ten this permission, if granted, is abused. The results are not beneficial to the national collections, while very harmful to the preservation of interesting wild animals. It is to be regretted, however, that in regard to Major Powell-Cotton's negatives and specimens

so much delay and petty annoyance should have been caused by the minor officials of the East African coast province.

The book contains many photographs of great interest illustrating the Nilotic negroes (Turkana, Dodinga, Tepeth, Lango, Karamojo, etc.), and a good deal of fresh light is thrown on the remarkable Elgon caves. The writer of this review adheres to his opinion that the original agent in the formation of the cave or hollow was water; but he has never denied—and certainly after Major Cotton's report would not wish to deny—that these caves have been enlarged, deepened, widened by the action of man.

There are some beautiful photographs of antelopes (notably one of an oryx), lion, hunting-dogs, and crowned cranes. Some of the pictures of cattle are interesting, as showing the distribution of certain breeds. Major Cotton, for example, is able to testify to the existence in Bukedi (far to the north-east of the Ankole plateau of western Uganda) of the long-horned, straight-backed cattle. The cattle of the Dodinga people and of most of the tribes he encountered seemed to belong to the humped, short-horned, zebu type. The long-horned, ordinarily straight-backed ox is at present one of the unsolved African problems. It is present in western and southern Nigeria, and in part of Somaliland. Major Powell-Cotton shows its existence, at any rate sporadically, in the Bukedi country to the north of Mount Elgon. It is the dominant breed in Western Uganda, and past the west coast of the Victoria Nyanza to the north-west coast of Tanganyika, wherever, in fact, the Hamitic aristocracy has penetrated. It can be traced westwards through the countries of the Dinka and Nuer to the eastern shores of Lake Chad. From Nigeria to the Gambia, it extends in a dwarfed form. It is apparently represented on the Egyptian monuments, on which it is given as straight-backed. At the present day this very long-horned type may be found in conjunction with a hump. No doubt this is due to intermixture with the more definitely Indian race which is so widely spread through Africa, and which differs from the long-horned type by its tendency to a blotched hide, and is known by that name of doubtful etymology—zebu.

Of course Major Cotton's book is interesting. It contains certain small inaccuracies of spelling, which might be remedied in another edition. The African sportsman several times referred to by the author is not Mr. Sidney Buxton, the ex-Under Secretary for the Colonies, but Mr. Edward North Buxton. In a good many cases the standard orthography of the Royal Geographical Society has not been adopted in the rendering of native names, and one is puzzled how to pronounce such spelling as "Pacey" (river). Amongst the appendices is a list of the native names for mammals in the Swahili, Masai, Suk, Dorobo, Nandi, and Turkana languages; but these again are somewhat spoilt by unscientific spelling, as, for example, where the Swahili *nyani* (baboon) is spelt *nearni*.

Herr Schillings's magnificent and hitherto unparalleled book is only marred by one feature, in that it is printed in that abominable German black letter, which a European congress should assemble to abolish for the general good of humanity. Fortunately for English readers, we understand that the book is to appear before long in an English translation, with of course a method of printing which will be less distracting to the impaired sight of the middle-aged and elderly. Like Major Powell-Cotton's book, the work of Herr Schillings would be more appropriately reviewed in the pages of the Zoological Society's Proceedings, since it deals principally with the life-history of beasts, birds, and reptiles. But it has a place in geographical literature, if only from its wonderful photographs of East African scenery—the peak of Kibo (Kilimanjaro); the Rufu river and its bordering

fringe of acacias or occasional patches of rich forest; the Masai steppes; the thorny bush; the scattered woodland through which the giraffes wander, halting at intervals to lose themselves to the eye of man amongst the tree-trunks and foliage; the roads, worn deep by the age-long migrations to and fro of elephants from feeding-ground to feeding-ground; the park lands with their clumps of handsome trees, branching hyphæne palms and gouty baobabs; the lakes, the swamps, the ravines, the floods, the thorn-brakes, the sanseviera thickets, and the rare patches of luxuriant forest of eastern equatorial Africa.

Herr Schillings belongs to that new school of sportsmen whose founders have been Mr. Edward North Buxton and two or three Americans—men who have taught us that it is a finer sport, and one more productive of an increase to our knowledge (as a general rule), to follow up big game with the snapshot camera and the telephotographic lens rather than with the rifle. Our museums must, it is true, have their complement of specimens; but we hope that men like the author of this book will bring the world of fashion into the better path of not rushing out to Africa when they have lost money or made it, fallen in love or out, to recklessly slay all sorts of interesting creatures so that they may become possessed of trophies with which to adorn their homes in England, the said trophies often finding their way eventually to dust and moth and rats in attics and lumber-rooms. Herr Schillings's book is a triumph; it takes the first rank in sporting works of the new description. It contains the most marvellous pictures of animal life in Africa that have yet been secured by the camera, more wonderful even than the photographs of Lord Delamere or the exact and faithful drawings of Mr. J. G. Millais. So far as one can judge, the photographs reproduced in this book are absolutely "unfaked." There are wonderful pictures of giraffes wandering through the acacia woods, of elephants with enormous tusks passing through the long herbage on the slopes of hills, of flamingoes in full flight against an evening sky, cranes and egrets, marabou storks, secretary birds, and vultures; rhinoceroses under the shade of a canopied tree; great eland bulls hiding themselves amidst a tangle of grey lianas and thorn branches, or boldly standing out among the lush herbage in the open; lions rushing on their prey, hyænas snarling at jackals; leopards coming down to drink, zebras in herds of uncountable numbers; the beautiful Grant's gazelle, with its long and graceful horns, browsing on the short grass that heralds the African spring; kingfishers on sprays of grass, bustards preparing to rise into flight, ostriches searching restlessly with their keen sight for the suspected presence of man; wounded buffaloes, snorting gnus, fringe-eared oryxes, long-necked gerenuk gazelles (like some extinct mammal in weirdness of outline); colobus monkeys, baboons foraging for food; nearly every large and small bird and beast of the East African wilderness. Amongst the photographs is a very interesting snapshot of the rare striped hyæna of Eastern Africa which has been named after Schillings, its discoverer. Many of these photographs have been taken by flashlight at night at some drinking-place, or alongside the bait of some dead animal placed there to attract scavengers. The beasts that are thus photographed have evidently unconsciously pressed the light trigger of an apparatus, and are thus snapshotted before they have had time to pass from a natural attitude. Here is the life of the wilderness displayed in the full, as it has not too often been seen by the average traveller in East Africa. More than any book yet put before the public, it enables the stay-at-home reader to realize what wild beasts and birds look like in their own homes.

The letterpress is as interesting as the illustrations, but the book will gain enormously in popularity by its being translated into English and printed with a type less injurious to the eyesight than the German black letter.

H. H. J.

AMERICA.

A Text-book of the Geography of North America.

'North America.' By Israel C. Russell. (Regions of the World Series.) London: Henry Froude. 1904. *Price* 7*s.* 6*d.*

Coming from the pen of a well-known writer on physiographical subjects in a country where physiography has been recognized as a subject for special study, this volume may be expected to contain a clear, forcible, and well-balanced description of the physical features of the region of which it treats. In this expectation we are not disappointed. The early chapters on the coastal margin, the relief of the land, mountain ranges, climate, and vegetation are excellent. They are evidently the work of one who has travelled far and wide, and lived the nomad life of a field geologist on the western plains and in the sierras. Written in an easy style, always clear and sometimes eloquent, the account of the various subdivisions of the North American continent is not overburdened with technicalities, and holds the attention of the reader. Some parts of the subject, like the volcanoes, lakes, and river histories, are passed over somewhat lightly, no doubt because the author has already said what he has to say about them elsewhere; and, as the space allotted is small, while the area to be described is enormous, a selection of material has evidently been made according to its importance and the accuracy of the data available regarding it. Perhaps for this reason attention throughout is focussed on the United States and Alaska, while Canada and Mexico are regulated to the background. But, within its limits of space, this work contains the best general account of North American physiography with which we are acquainted.

The remaining chapters, however, are less successful. They treat of the animals, the geology, aborigines, political geography, and kindred subjects. American geologists have often declared that theirs is a typical continent, exhibiting in its structure and history the changes and development through which a great land-unit should pass. There is certainly room for a clear outline of the geology of North America suitable for educated readers who may be supposed to have no special knowledge of the subject. This the author has not even attempted to give, possibly because he considered it outside the scope of the volume, and the geological chapter is thin and flaccid. Even less satisfactory is the description of the natural resources of the country and the important part these have played in its development and the distribution of the population and industries; this part of the book is dangerously like a catalogue of the localities of useful minerals. The chapters on the aborigines and on the present political subdivisions are brief and sketchy compared with the full treatment accorded to historical and political geography in other volumes of this series. It is explained, however, that this is not altogether the fault of the author, as the fuller details on these subjects which he intended to give have been crowded out by lack of space. Undoubtedly the physical chapters, which have been retained, are by far the best in the book, and the only criticism that seems applicable is a regret that, in planning the volume, the scale of its parts has not been more carefully considered from the first.

J. S. F.

Geology of Alaska.

'Harriman Alaska Expedition: Alaska.' Vol. iv. Geology and Palæontology. New York: Doubleday, Page & Co. 1904.

Everything which can be done to make a book presentable by elegant printing, excellent paper, and abundant illustrations has been lavished on this volume. This, however, hardly redeems it from being a collection of casual scientific papers,

of very unequal interest. The best are those by Dall and Ulrich on the palæontological material collected by the expedition. Seven new genera and thirty-eight new species of invertebrates and plants are described and figured. Those from the Yukatat beds are specially interesting, and form a useful addition to the rapidly growing literature of Alaskan geology.

J. S. F.

The Geology of Para.

'Grundzüge der Geologie des unteren Amazonasgebietes.' By Friedrick Katzer. Leipzig: Max Weg. 1903.

A work of this kind, giving a general account of the geology and surface features of an area extending over hundreds of thousands of square miles, must of necessity be of the nature of an outline sketch. Much of the country is covered by swamp, jungle, and forest, and consists of the alluvia laid down by the great river and its tributaries. These gravels, sands, and clays are sometimes auriferous, and carry large numbers of irregular concretionary blocks, which led Agassiz to formulate his striking but erroneous theory of the glaciation of Brazil in recent geological times. Flat-topped, steep-sided hills of Tertiary beds rise above the level of the plains, and rest with a marked unconformability on Permo-Carboniferous, Devonian, and older strata. The author's account of the little-known Devonian rocks of the Amazon valley is of special value. They are often steeply inclined, and are penetrated by dykes and sheets of diabase. The Silurian is known only on the south side of the river. Metamorphic schists and gneisses of various kinds, representing an Archæan floor, emerge at various points and occupy an enormous area along the headwaters of the northern tributaries.

The physical history of the Amazon valley is in some ways very remarkable. The palæozoic strata of the region are marine, the Tertiary beds are fresh-water, and Mesozoic rocks are almost unrepresented. This is interpreted by the author to mean that continental conditions have prevailed since the Permian, and, if this be the case, the area is one of very great stability. The principal uplift has apparently taken place to the east, as the oldest rocks may be traced in a great crescent extending across the river's mouth and passing backwards on each side, while the latest deposits are laid down along the centre of the basin. During the Tertiary epoch great lakes and streams occupied the surface, and at first probably drained westward to the Pacific, but as the Cordillera slowly rose the drainage was obstructed, and finally the course of the river was reversed. This is a very curious hypothesis, and not entirely in accordance with the work of other investigators of Brazilian geology, but the evidence in favour of it is given with great clearness, and deserves careful consideration.

Dr. Katzer's work is certainly a concise and valuable compendium of the subject on which it treats, and will be welcomed by all who are interested in the geology of South America.

J. S. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

New Issue of Huxley's Physiography.

'Physiography.' By T. H. Huxley. Revised and partly rewritten by R. A. Gregory. London: Macmillan & Co. 1904.

Huxley's 'Physiography' is a work so well known and, in a sense, so unique that the attempt to bring out a revised edition of it is sure to be watched with interest. The editor has had a difficult task, and we have only praise for the

manner in which it has been accomplished. By carefully retaining as much of the old fabric as possible, and incorporating such additional material as was necessitated by the advance of science, it has been brought abreast of the times, while it still retains the old lucidity of treatment. Surprisingly little modification has been needed in most of the chapters, and the only vital alteration is that what was intended to be a study of the Thames basin, which should appeal mainly to youths living in London, has been given a wider scope and made more suitable for general readers. In this some loss of directness was inevitable, and the new material introduced—principally a chapter on geological structures and their meaning—is hardly up to the old standard. The work has been slightly abridged by the excision of the less important allusions in the original edition, but this seems to us a positive improvement. A large number of process blocks have been introduced into the text. They are admirably chosen, and, for the most part, successfully reproduced, and need only to be compared with the old woodcuts to show how great are the advances in cheap book-making within the last twenty-five years. Very wisely, no attempt has been made to conform strictly to current syllabuses. In its new form the book will interest a large public and have an extended lease of life.

J. S. F.

THE MONTHLY RECORD.

THE SOCIETY.

The Awards for 1905.—The Royal medals and other awards of the Society have been bestowed this year as follows: The Founder's Medal to Sir Martin Conway, for his explorations in various mountain regions and in Spitsbergen, prosecuted during a long series of years, and for the valuable contributions to geography resulting from those explorations in the form of papers, maps, and other publications; the Patron's Medal to Captain C. H. D. Ryder, R.E., for his survey of Yunnan carried out in 1899–1900 in association with Major H. R. Davies, and especially for the extensive and valuable work accomplished in connection with the recent Tibet Mission; the Victoria Research Medal to Mr. J. G. Bartholomew, for his long-continued services to British cartography, as shown particularly in the large atlases issued or planned by him, including the first volume of a great physical atlas, which will take a foremost place among works of its kind. Of the other awards, the Murchison Grant is given to Mr. William Wallace, C.M.G., for the great services rendered, directly or indirectly, to Geography during his service as an official in Northern Nigeria; the Gill Memorial to Colonel F. R. Maunsell, R.A., for his explorations in Asiatic Turkey, and for the large map he has compiled, largely from his own materials; the Cuthbert Peek Grant to Mr. Francis J. Lewis, for his valuable researches on the distribution of vegetation in the north of England, the results of which have been published in the *Journal*; and, lastly, the Back Grant to Captain Philip Maud, R.E., for his valuable survey work along the southern border of Abyssinia in 1903.

EUROPE.

Recent Movement of Elevation on the Irish Coast.—The subject of the oscillations of the relative level of the land and sea is receiving unusual attention at the present time, and the data available for the study of the subject are yearly becoming more extensive. Important researches into the most recent changes of level on the Irish coast have been lately made by Messrs. Coffey and Praeger, who have published the results of their examination of this region in the *Proceedings of the Royal Irish Academy* (December, 1904, vol. 25, Sect. C, pp. 143–200). The most striking of the features on the coasts of Antrim and Derry, which prove fluctuations to have taken place since the close of the Glacial period, is the well-marked shelf or terrace which is seen at various points; but the whole of the evidence is considered by the writers under the general headings of Phenomena of Erosion and Deposition. Of the former, the best-marked feature is the steep scarp at some distance from the present beach, and at some height above it, which marks the former encroachment of the waves. The scarp is frequently cut in the boulder-clay, but often, again, in much more ancient rocks. Between it and the present beach there is a level or slightly sloping plain representing the former beach or sea-bed. The deposits now laid bare by the uprise along this coast are extensive and varied, gravel and sand being found where the shores were open or where currents prevailed; mud where the waters were deeper or quieter. The character of the faunal remains furnishes valuable evidence as to the depth of the water and the conditions under which the organisms lived. The raised beach of Larne, a long tapering gravel bank heaped up by tides, is the best-known example of this category; but the finest deposits are the series of estuarine clays, etc., which can be studied particularly well at the new Alexandra Dock, Belfast. The post-Glacial geological history seems to have been as follows: In quite early times the land stood more than 30 feet higher than at present. Then followed a subsidence of not less than 55 feet, resulting in a land-level at least 25 feet lower than the present; for though no shelf has been found at a level corresponding with this depression, while the 10 to 15 feet shelf is on the other hand well marked, there seems no possibility of doubting the evidence of the deposits, and it is possible that an earlier beach has been cut away during the formation of a later one. A renewed movement of elevation probably raised the level about 5 feet higher than the existing one, a slight movement of submergence having brought about the existing conditions. These movements in the Belfast district are capable of close correlation with similar movements in the Mersey district, and in those of the Forth and Tay, the most distinctive character throughout the whole of this section of the British isles being the sharp Neolithic * uprise, which appears to die out rapidly both to the north and south. In the south, while a high land-level in early post-Glacial times, followed by submergence, is likewise traceable, the latter movement has been maintained, continuously or intermittently, down to recent times. It therefore appears that these recent slight fluctuations are of an uneven and local character, and no support is found for the view of Suess that it is the sea rather than the land-level which has shown a variation.

The Arctic Marine Fauna of Danish Lakes.—Dr. Wesenberg-Lund discusses in the *Geografisk Tidskrift*, Hefte 8, Bd. 17, the origin of certain forms in the Furesø. About forty-five years ago the Swedish naturalist, Sven Lovén, drew

* In the section of the paper devoted to archæology much care is taken to correlate the movements above described with early human periods.

attention to the Arctic relict fauna in the Swedish lakes, which he showed from geological data to have been an arm of the sea. Soon the number of so-called relict lakes was considerably increased, until at length all lakes received the name, in which forms originally marine were found to exist. In 1888 Credner protested against this view in his 'Reliktenseen,' pointing out that salt-water organisms can reach lakes through their drainage streams. Nor has the migration of these organisms been confined to the post-glacial period, as is proved in many parts of the world, especially in the case of the Jurassic marine fauna of Lake Tanganyika. There are also examples in quite recent times of the penetration of marine forms into lakes and rivers. In 1899 Dr. Lund discovered the form *Pallasiella quadrispinosa* and *Pontoporeia affinis* in the Furesø, and in 1902, *Mysis relicta*. The last has been studied by MM. Samter and Weltner in the lakes of North Germany. It makes for the lower colder depths in summer, being unable to bear a temperature above 57° Fahr., and it lays eggs only when the temperature is low. *Pontoporeia affinis* also retires to the deeper layers when the temperature rises, though it can bear a somewhat greater degree of heat; while *Pallasiella* propagates its species throughout the year, and bears a temperature which throws a doubt on its being a glacial form. Dr. Lund describes the Furesø, and decides that it was never reached by the sea. The time of its formation is unknown, but the whole neighbourhood shows signs of glaciation. The Arctic forms probably reached the lake when the oak was the prevailing tree, when the sea was only two-thirds of a mile distant on the east, and at least 7 miles on the west. Probably when the salt water penetrated into the *Ancyclus* lake, the fauna took refuge in the mouths of the rivers, and ultimately reached the lakes, and among other forms would be those of Arctic origin which had adapted themselves to the fresh water of the *Ancyclus* lake.

ASIA.

Lieut. Filchner's Expedition in Eastern Tibet.—Lieut. Filchner is a young German officer who some years ago set himself the task of exploring some of the still unknown regions of inner Asia. As a preliminary attempt he made a journey in the Pamirs, which he described in a narrative published two years ago. He has since made a more extended journey, this time in what is probably one of the least-known districts on the borders of China and Tibet—that stretching south-east from the upper Hwang-ho to the western frontier of Suchuan.* Lieut. Filchner (who belongs to the Bavarian army) is on his way home through America, but some account of the journey has already been given (from letters sent home by his companion, Dr. Tafel) in the *Zeitschrift* of the Berlin Geographical Society (1905, No. 3). Dr. Tafel being a geologist, his report throws a valuable light on the physical configuration of the region traversed. The explorers made their way first from Shanghai *viâ* Singan-fu to Sining, on the borders of the Koko-nor province, Lieut. Filchner being accompanied thus far by his wife. It was their intention, if possible, to follow the course of the Hwang-ho through the great bends which, according to Chinese maps, it makes during the interval between its exit from the Oring-nor and the point where it was crossed by Drs. Holderer and Futterer; and though this could not be carried out in its entirety, a considerable stretch of the river's course was examined. The start from Sining was made on June 24, 1904, and on July 20 the Hwang-ho was reached at the spot where it was crossed by Grenard. The stream was, however, in flood, and it was necessary to

* A part of this region was traversed by Mr. Birch and Captain Watts-Jones in 1900, but, as the expedition ended fatally for both travellers, no precise details as to their route are available (cf. *Journal*, vol. 21, p. 651).

ascend almost to the Oring-nor before it could be crossed. The travellers then went south to Lake Kala-namtso and followed down the winding course of the Richu to its confluence with the main river, continuing east and east-south-east along the latter until its great bend to the northward, when the perpendicular cliffs of sandstone made it impossible to follow it further. The trade-route to Sungpan on the headwaters of the Min (visited by Gill and various travellers from the south) was then struck, and led over an elevated region with snowy passes,* the chief difficulties arising, however, from the inhabitants, who on October 1 made an organized attack on the party and plundered them of all their baggage. The remainder of the way to Sungpan was therefore accomplished amid great difficulties and hardships, the return to Sining being by way of Lau-chau. Dr. Tafel gives interesting notes on the geology and physical geography of the region of the upper Hwang-ho. North of the river various chains of mountains were crossed, some consisting of limestone and schists, some of granite, these last being apparently the snowy ranges of Prjevalski. They are, however, not so important as they have been shown on the map. In the neighbourhood of Tossun- (Tosso-) nor, chains composed of coral-limestone with great numbers of fossils occur, and south of the lake a vast area composed of hard green, blueish, or grey sandstone, traversed by quartz veins, extends almost to Sungpan. The Amne-machin range is composed of this, and the whole upper course of the Hwang-ho with its lakes lies in the same formation, which alternates with black clay-slate, and has a strike parallel to the direction of the river. After having been cleared by its passage through the Oring-nor, the Hwang-ho becomes turbid for a time on account of a red clay which occurs near it; but as its tributaries, which almost all flow in from the south, have clear water, it becomes clearer once more. In one section it passes through a remarkable series of sand-dunes and barkhanes. The side valleys all join it at a sharp angle, which causes the water to be impounded in a series of lakes. Their general direction (which corresponds with that of the quartz dykes) was N. 10° E., which seems due to an extensive series of fractures. Glacial traces were more than once observed, and the Kala-namtso lake is a shallow moraines-girt basin, contrasting strongly with the rock-bound Oring-nor. North of the Amne-machin range the valleys are wide and steppe-like, while to the south their floors are filled with pools and morasses. An abnormal amount of rain seemed to have fallen last year throughout the whole region.

Lake Exploration in Asiatic Russia.—The Russian geographers take a considerable interest in limnology, and we find in the last number of the Moscow periodical *Zemlevyedenie* (1904, 1 and 2) several papers devoted to this subject. L. Berg gives a very good monograph of Lake Issyk-Kul, with a map and a few photographs. According to the last geometrical measurements the altitude of the lake is 5165 feet, and its depth reaches about 425 metres (1400 feet) in its deepest portion, 33 miles from the southern coast. It is interesting to note that a uniform depth of 256 metres (840 feet) prevails in the middle portions of the lake, thus reminding one of the "plaine centrale" of the Lake of Geneva. The depth decreases towards the east, but even there depths of from 57 to 70 metres (185 to 230 feet) are found. It is well known that the river Chu, after having approached very closely to the lake, suddenly turns northward and pierces a lofty mountain range. We have thus in lake Issyk-kul and the Chu the very same phenomenon as in the Lake of Geneva and the Arve, in Lake Baikal and the Irkut, Lake Ulungur

* Mr. Birch crossed two passes at a height of nearly 14,000 feet, probably somewhat further east. He had no difficulty with the Mantse tribes encountered on his route.

and the Black Irtysh, Lake Bagrach-kul and the rivers Haidyk-gol and Konche-Daria, and many other lakes of Asia. In all these cases, we have not merely instances of rivers which have filled up their beds with their own deposits, but also of a sinking of the level of the lakes during a recent geological period. Berg indicates further on that the Issyk-Kul has probably its *seiches*, which are evidently increased in the event of earthquakes. A considerable amount of attention is also given to the changes of level in the lake; and it may be taken as certain that during the years 1859 to 1897 the level of the lake was sinking, for all available testimony agrees in this respect; but it is also not less certain that since the year 1900 a rising of level has taken place. It seems, also, doubtless that this rise is caused by a temporary increase in the precipitation. Thus the average precipitation at Prjevalsk was 385 millimetres during the years 1891–1895, and 554 millimetres during the three years 1896, 1901, and 1902. The same increase is seen at Vyernyi, where the precipitation was—

1881–1890	550	millimetres.
1891–1900	592	,,
1901	815	,,
1902	809	,,

A considerable increase in the quantity of water discharged by the Chu has also been noticed. As to previous geological periods, it is certain that the lake once stood several hundred feet higher than it stands now; but this must have been at the time when the glaciers of the Tian Shan had a much greater development than the present one. Berg also passes in review the geology of the surrounding mountains, and shows that they contain no traces of *marine* deposits younger than Devonian and Carboniferous, and that the so-called Hanhai deposits are not of marine origin, but aërial. He also speaks of the effects of earthquakes resulting in local subsidences, and concludes his very valuable monograph by a sketch of the climate of the region. Another interesting paper deals with the exploration of the "Lakes of the Kokchetav district of the Akmolinsk province," by P. Ignatov. These lakes have been rapidly drying up since the beginning of the nineteenth century. All this part of the Kirghiz steppe is dotted with such lakes, all of which have but a small depth. Two more papers deal respectively with one of the lakes of the Senno district of Moghileff and the lakes of the government of Vitebsk. All are accompanied by bathymetric maps and some photographs.

Expedition to the Khatanga River, Northern Siberia.—We learn from the *Geographische Zeitschrift* (1905, No. 2) that a scientific expedition has been organized in Russia for the exploration of the Khatanga river in northern Siberia. The scientific staff consists of J. Tolmacheff, curator of the geological museum of the academy; Mr. Backlund, astronomer; and Mr. Koshevnikoff, topographer. The programme includes (besides geological researches) the survey of Lake Yessei, the position of which is not yet accurately fixed; a visit to Lake Monero; and a search for the lake Voievoli, reported by the Tunguses. It is hoped, also, to ascend the Khatanga in boats, and to examine the mouth of the Monero river. The expedition is due to the initiative of the academician F. Schmidt, who has contributed eight thousand roubles to the expenses, the remainder being borne by the Imperial Russian Geographical Society.

AFRICA.

The Segonzac Expedition in Morocco.—The Marquis de Segonzac, whose excellent geographical work during his first expedition in Morocco is known to readers of the *Journal*, last year undertook a new expedition, which has resulted in valuable additions to our knowledge, although the detection of the leader's

disguise as a Mohammedan has unfortunately led to his imprisonment by the Berber tribe of Seketanas. A short account of the expedition from its commencement is given in the supplement to the *Tour du Monde* for April 1. The explorer was accompanied by M. Gentil, as geologist; M. de Flotte Roquevaire, well known for his previous contributions to the mapping of Morocco; with a Berber and an Arab interpreter. Arriving at Mogador, the travellers found it necessary to separate, so as better to escape suspicion, M. Gentil undertaking the geological examination of the country bordering on the south-west extremity of the Atlas, M. de Flotte the triangulation of the region between Mogador and Marakesh, while M. de Segonzac took in hand the exploration of the Great Atlas and its southern border. The journeys of the last named are of special interest. From Marakesh he followed the northern foot of the Atlas by Sikahal and Demnat, afterwards penetrating into the interior of the range by the valley of the Wed El Abid, a southern tributary of the Um-er-Rebia. From this he crossed by a comparatively easy pass (which offers facilities of communication between the two versants similar to those afforded by the Teza gap in the north) to the upper Muluya valley, there effecting a junction with his surveys of 1901. This river was found to have its source further to the west than had been supposed. M. de Segonzac then crossed the great Atlas, in the neighbourhood of Mount Aiashi, and made his way to Tafilet by the valley of the Wed Gheris. It was during the further journey towards the coast of the Atlantic, still on the southern side of the Atlas, that the traveller was made prisoner. In this region of hereditary sheikhs and small Berber settlements the sultan's influence is but small, and the release of the prisoner will probably depend on the payment of a ransom. Besides studying the political and ethnographical relations of the regions visited, the traveller had collected a considerable number of fossils and other geological specimens.

The Upper Valley of the Dra, Morocco.—In spite of recent exploring activity in Morocco, there still remain wide districts on which our information is very scanty, and among these is the valley on the upper Dra, on the south side of the Atlas, to which only a few Europeans, such as Caillié and De Foucauld, have yet penetrated. Some information on a portion of this region has been collected by Captain Regnault (*Renseign. Coloniales, Comité de l'Afrique Française*, No. 1, 1905), who, without himself visiting it, has made careful inquiries from an intelligent and travelled native, Lhassen ben Aissa by name, whose home is at Tiraf, in El Ktaua, the district in which the Dra reaches the most easterly extension of its course.* In questioning his informant, Captain Regnault had recourse to a species of object-lesson, the district to be studied being outlined on a piece of sandy ground, on which the relative bearings of the principal localities were laid down, and the distances between them estimated. The result is shown on a sketch-map accompanying the paper. The districts on the section of the Dra in question are, from below upwards, Mhamid, El Ktaua (pronounced Lektaua), Fezuata, Ternata, and Tinzulin. Throughout these the Dra is a permanent stream 30 to 40 yards wide at ordinary times, with a depth of 2 or 3 feet. In time of flood the width becomes half a mile and more, and the stream sometimes invades the palm groves and washes the walls of the "ksur." The region is generally rich, and irrigation of the palm groves and cultivated lands is carried out by means of canals which sometimes serve two or three "ksur" at once. Below Mhamid the river-bed is dry except at unusually high floods. The valley is flanked by hills 150 to

* Information was collected in a similar way some years ago by the Comte H. de Castries, whose "Notice sur la région de l'oued Dra" (*Bul. Paris Geog. Soc.*, 1880) has been one of the best authorities on this region.

300 feet in height, which now recede, forming wide basins, and again close in to form narrow passes. One of these, south of Ternata, is less than 1000 yards wide (600 to 800 metres). The paper contains details as to productions, industries (chiefly the weaving of fabrics and tanning of goatskins), commerce, administration of justice, and so forth.

Mr. Cunnington's Zoological Researches on Lake Tanganyika.—Mr. Cunnington, who was last year sent out by the committee for the scientific exploration of Lake Tanganyika to carry on the investigations begun by Mr. J. E. S. Moore, has lately sent home a report of his experiences down to October 29, 1904. On his way up Lake Nyasa he had obtained good collections of the minute fauna and flora characteristic of the lake's surface. The temperature of the surface water was found to rarely fall below 70°, while at 76 fathoms below the surface it was found to be about 3° higher. On Tanganyika he obtained a dhow in which to move about at will from one part to another, and he had already made a good collection of fishes, besides many freshwater crustaceans. The vegetable life seemed to present marked resemblances with that of Nyasa.

Dr. Uhlig's Latest Expedition in East Africa.—We have more than once alluded to Dr. Uhlig's fruitful researches in East Africa, both in the region of Mounts Kilmanjaro and Meru and on the Victoria Nyanza. His latest journey, which was begun in July, 1904, in company with Dr. F. Jaeger and Herr Gunzert, led again to the neighbourhood of the two great mountains, but was continued beyond Meru to the region of the Natron lake in the southern portion of the rift-valley (*Zeitschrift*, Berlin Geographical Society, 1905, Nos. 2 and 3). As already recorded in the *Journal*, Dr. Uhlig made a second ascent to the Kibo crater of Kilimanjaro, and discovered that the glaciers had diminished sensibly since his visit in 1901. The journey from Meru to the rift-valley led over the almost waterless steppe by a route that had not previously been surveyed. Early in September the still active volcano of Oldonyo l'Engai (Donyo Ngai) was ascended, Herr Gunzert reaching the actual summit (about 9200 feet above the sea), while on account of the heat and want of water his companions were forced to stop at some 800 feet lower. The sulphurous exhalations from the crater were perceptible to the smell over 1500 feet below the summit. It is a cone of tuff rising 6500 feet above the plain, and apparently resting on lava of not much greater age. Among the volcanic phenomena of the steppe is a series of small lakes ("Maare"), the sides of which sink so suddenly in the level plain that they often cannot be seen until closely approached. From the south-west shore of the "Magad" or Natron lake, the travellers ascended the side of the rift-valley, and made their way to Sonyo and Engurman (Nguruman), noticing the extraordinarily complicated structure of the western wall of the valley. The old volcano of Sambu (7879 feet) was climbed, and afforded a splendid view over the Natron lake. The volcano has been cut in half by the second great dislocation, and this has also been the fate of several other volcanoes to the west of Donyo Ngai, which have not been marked on the maps. The largest of them, called the Masai Elanairobi, was ascended. Its height of 12000 feet makes it the highest summit to the west of the rift-valley. After various other investigations a return was made to Meru, which was once more ascended, and steam was found to issue from the innermost cone of ashes within the crater. The volcano may therefore be classed as active. Besides the surveys and geological researches, a collection of over 500 plants was made and 450 photographs were taken. Dr. Uhlig also paid attention to the advantages offered by this region for settlement by Boers, and came to the conclusion that the grassy steppes west of the rift-valley are well suited for the purpose.

New Districts in British East Africa.—By a proclamation dated February 11,

1905, the Masailand district of the Ukamba province has been divided into two separate parts, viz. the Kikuyu and South Masai districts, the headquarters being for the present respectively Dagoretti and Nairobi. The precise limits of the districts are defined in the *Official Gazette for East Africa and Uganda* of March 1.

The Germans in the Shari Basin.—An interesting journey on the Logone, the great tributary of the Shari, has lately been made by Captain Stieber, Resident for the German Chad territories, from his headquarters at Kusseri (*Deutsche Kolonialzeitung*, No. 8, 1905). It was undertaken mainly with a view to strengthening German influence in the Shari basin, but the leader's notes on the present condition of the Musgu country through which he passed contain much new information. In particular he gives a striking account of the density of population, the route passing for days and weeks through a succession of houses, farms, and cultivated fields. Further south, as the French boundary was approached, the density became somewhat less, though still considerable. The expedition succeeded in opening friendly relations with the natives, who were glad to be assured of protection against attacks from the side of Bagirmi. Near the boundary relations were entered into with the French officials, and a provisional frontier agreed upon, though when the surveys of various travellers in this region have been worked out it is probable that it will have to be shifted to the advantage of Germany. The return journey was made by a more easterly route, which followed the Ba-Ili for some distance. This stream was over 75 yards wide where crossed, but had no current, and in the dry season dries up almost entirely. It forms the eastern limit of the Musgu country. Captain Stieber does not share Captain Lenfant's sanguine expectations as to the value of the waterway between the Benue and Shari, owing to its shallowness and the fact that it is open for a few months in each year only. He thinks, however, that it is not impossible that a better channel than that followed by Lenfant may exist.

Southern Nigeria.—The Colonial Office Report on Southern Nigeria for 1903, No. 433, records a less heavy rainfall than in 1902. The mean rainfall for the five meteorological stations was 104·94 inches. At Old Calabar the rainfall was 141 inches, the wettest month, July, with 34 inches, being thirty-seven times wetter than the driest month, March, and twenty-three times wetter than the next driest month, January. Twenty-five rivers and creeks have been cleared of obstructions and charted during the year. From a coast-line 300 miles long, the area extending for 50 miles inland is all a network of waterways, and main rivers connected by creeks run out to sea by mangrove-fringed courses. Hence the necessity of having them cleared for launch and canoe traffic. To the staple products, palm oil and palm kernels, some few others may now be added. Thus the area of rubber plantations has been extended, and a few chiefs have been induced to begin operations. The native obstinacy in refusing work not promising an immediate return is, however, a standing drawback to the rubber, caco, and coffee industries. The timber trade, non-existent a few years ago, exported in 1903 460,446 superficial feet (valued at £32,027), or treble the export of 1902. The tonnage of British shipping shows an increase of 23·2 per cent., and foreign shipping of 32·7 per cent. over 1902. More than a quarter of the protectorate is not yet under control.

AMERICA.

Exploration in Dutch Guiana.—A full account of the Saramacca river expedition, by Lieut. A. J. van Stockum, appeared in the *Tijdschrift* of the Dutch Geographical Society, 1904. As reported in vol. 22, p. 217, the river was traced to the

Zuidheuvel, now called the De Kock mountain. On the eastern side the Van Asch van Wyck range runs north-north-east. One of the higher peaks, the Ebba-top, 2560 feet high, in lat. 4° 20′ N., was ascended, and an excursion was made to the Hendrik-top, in the Emma range (vol. 20, p. 636). A map accompanies Lieut. van Stockum's article, and a report on the rock specimens by Heer C. Moerman. Another expedition, under the leadership of Lieut. A. F. Herderschee, spent the autumn of 1903 on the upper Marowijne or Lawa, and explored the Goninie, which lies between the Lawa and the Tapanahoni, and is formed by two streams, the Emma and Wilhelmina, descending from the Orange hills, 1200 to 1500 feet high. Then the Litanie, the western head-stream of the Lawa, was ascended to the Tumuc-Humac mountains, which here run from south-east to north-west with a height of 2300 to 2600 feet. The country was carefully mapped, the survey of the boundary commission of 1861 being completed as regards the Lawa, meteorological and magnetic observations were taken, and rock specimens and ethnological objects collected. Last autumn Lieut. Herderschee returned to Paramaribo, in order to complete the exploration of the Tapanahoni, the lower section of which he had visited on the former expedition. From a granite top 650 feet high, the Orange mountains were seen to bend south-westwards to a mountain 3900 feet high, the Kassikassi-ma, which subsequently proved to be inaccessible. The Palume was ascended as far as 2° 50′ N. lat., and one of the party, Heer Goeje, proceeded farther up the river to look for the Trio Indians, who are almost unknown to Europeans. They have only one village at the sources of the Palume, most of them dwelling on the upper Paru, beyond the Tumuc-Humac range. The Indians on the Tapanahoni have no knowledge of the upper Suriname and Corentyn, though they are well acquainted with the Yari and Paru (*Tijdschrift*, 22, No. 1).

Voyage of the "Neptune" to Hudson Bay and Baffin Bay.—The *Neptune*, which sailed in the summer of 1903 on behalf of the Canadian Government to the northern waters of the Dominion, with a view to more firmly establishing Canadian authority in those regions, returned to Halifax in October of last year, after accomplishing some useful work. Mr. A. P. Low, the well-known geologist and explorer, went with the expedition, and we learn from *Petermanns Mitteilungen* (1905, p. 72) that he has made a preliminary report on the expedition in the thirty-seventh annual report of the department of Marine and Fisheries, which we have not, however, yet received. The surveys carried out by the expedition will, it seems, considerably improve the basis for the mapping of these regions, the coast of Hudson bay between Chesterfield inlet and Wager bay having, in particular, been examined during a winter sledge expedition.

Navigation of the Uruguay.—A report issued by the Argentine Ministry of Public Works, as an accompaniment to the Argentine hydraulic exhibits at the late St. Louis Exhibition of the United States, sets forth the progress made by the commission charged with the survey of the Uruguay river between River Plate and Concordia with a view to its improved navigation. The survey between Concordia and Concepción del Uruguay has been completed. Observations made at the different tide-gauges set up by the commission in the river have not only established the fact, formerly suspected, that some tides reach up to Concepción, but have determined the law of their occurrence and their amplitude. Apart from wind, ordinary tides, due simply to lunar attraction, extend 182 miles up to Nueva Palmira, where they attain 6 to 10 centimetres in height. Extraordinary tides, on the other hand, under the influence of winds of the second and third quadrant, travel up to Concordia, reaching there a height of over 1 metre. This is itself a proof of the very gentle fall of the Uruguay. The mean fall of the river at ordinary high water is 0·06 metre per kilometre between Concordia and Nueva

Escocia, and 0·015 metre between Banco Grande and Fray Bentos. The ocean navigation of the Uruguay extends to below San Francisco bar; the coast navigation up the river to Concordia. The former is effected by vessels of 700 to 1000 tons, drawing up to 18 feet; the latter by river steamers carrying 300 passengers and 550 tons of cargo and drawing 9 feet, by towed lighters of 300 to 600 tons; and by small coasters carrying 30 to 100 tons and drawing 5 to 8 feet. At several ports on creeks the cargo has to be transhipped into smaller steamers. The yearly traffic in the Argentine ports of the Uruguay is about 350,000 tons, a volume which would, with improved navigation, be increased, as many cargoes now going direct by rail from Montevideo, etc., would then return to the use of the river route. The report gives a detailed description of the lower and middle Uruguay, and a brief account of the works carried out in 1902 and 1903.

AUSTRALASIA AND PACIFIC.

The "Albatross" Expedition to the Eastern Pacific.—The extract from a letter from Prof. A. Agassiz, giving details as to the work of the *Albatross* expedition down to November 28, 1904, is printed in the *American Journal of Science* for February, 1905. The expedition left San Francisco on October 6, and during the voyage to Panama made collections of pelagic material, both from the surface and to a depth of 300 fathoms. Off Mariato point two hauls were made in the vicinity of the stations which in 1891 yielded "modern green sand," the specimens of which were then, however, unfortunately lost, so that the rediscovery of the same sand on the recent voyage is of much interest. After visiting Panama and returning to Mariato point, a line of soundings was made toward Chatham island, in the Galapagos, the deepest point (1900 fathoms) occurring about 100 miles south-west of Mariato point. Beyond this about 1700 fathoms was shown for nearly 200 miles, the bottom then shoaling gradually to 1418 at about 80 miles from Chatham island, and then sloping quite rapidly for the remainder of the distance. Other lines were also made, including one from Aguja point first south-west, and afterwards east to Callao; a depth of over 320 fathoms being found in the Milne-Edwards deep about 80 miles off that port. Prof. Agassiz gives some notes on the pelagic collections, which on the whole were remarkably rich. They are remarkable for the variety and number of pelagic fishes which, though many of them had been considered as true deep-sea fishes, were obtained inside the 300-fathom line at a considerable distance from shore. The number of diatoms found in this tropical region was also interesting from the fact that they have usually been considered characteristic of more temperate and colder regions. The great variety of organisms contained in the hauls, even on successive days, showed the impossibility of making at sea a quantitative analysis of the pelagic fauna and flora at any one station within the influence of such a great oceanic current as the Chile and Peruvian stream.

POLAR REGIONS.

The Peary Arctic Expedition.—The vessel in which Commander Peary's new expedition is to make its way north in July next (see March *Journal*, p. 332) was launched at Bucksport, Maine, on March 23. On the following day the *Roosevelt*, as the ship has been christened, was towed to Portland, where she is now being fortified to withstand the pressure of the Greenland ice, and where she is being fitted with engines which will develop from 1000 to 1500 horse-power. In technical phraseology, "a three-masted fore-and-aft schooner-rigged steamship with auxiliary sail power," the *Roosevelt* is described as similar in general design to the modern steam-whaler, though with rather sharper lines. Her sides and bows, however, have been specially rounded, so that she may be able, if squeezed by the ice, to lift herself free. The *New York World*, from which these particulars are

taken, reports the principal dimensions of the vessel as—length over all, 182 feet; beam, 35·5 feet, depth, 16·3 feet; mean draught, with stores, 17 feet; gross tonnage, 614 tons; estimated displacement, about 1500 tons. White oak has been used in her construction; treble frames and double planking give her walls a thickness of from 2 to 2½ feet; 12 feet of solid dead wood strengthen the bow, while false keels and keelsons, 6 feet deep, run along the entire length of the ship. At the luncheon which followed the launching of the *Roosevelt*, Commander Peary announced that in all probability the commander of the vessel would be Captain Bartlett, who, it may be remembered, served the explorer in a like capacity throughout his last great expedition. A base camp will be established, and in the spring of next year the persistent explorer, supported by a company of picked Eskimo with dogs and sledges, will make a great effort to reach the pole. He hopes to return to New York in the autumn of the same year.

Captain Amundsen's Expedition to the North Magnetic Pole.—A record left by Captain Amundsen on Beechey island (south-west corner of North Devon) in August, 1903, and found there last summer by the *Neptune*, shows that good progress had been made down to that date, little or no ice having been encountered during the passage through Lancaster sound. The expedition had carried out some magnetic and geological work, and was about to start onwards through Peel sound. The depôt established by the British Government on Beechey island had been entirely destroyed, though the Franklin monument was intact.

The Ziegler Arctic Expedition.—A fresh relief expedition is to be sent out this summer to attempt communication with Mr. Fiala, who went north by the Franz Josef Land route in the summer of 1903, and has not since been heard of. The *Terra Nova*, the second relief ship of the British Antarctic Expedition, has been bought for the purpose.

Ellesmere Island.—This designation has now been adopted by the Geographic Board of Canada for the insular mass to the west of Smith sound, in deference to the suggestion made last year in the *Journal* (vol. 24, p. 230). The name previously assigned was "Ellesmere Land."

Glaciers in Greenland.—Dr. Engell was sent out in the summer of 1902 by the commission for geological and geographical investigations in Greenland to examine the glaciers in the neighbourhood of Jakobshavn. This is the largest colony in north Greenland, and has a very productive fishery, but yet the houses are among the most wretched in the country. The Jakobshavn glacier has retreated considerably since 1850, and a contraction is perceptible in a vertical direction. The level of the water in the two lakes beside it, the Nunatap Tasia, was found to have fallen 118 feet in the western and 92 in the eastern basin below the highest level it had formerly attained. Blocks sometimes fell from the face of the glacier, but there was no proper calving. The movement of the glacier was about the same as Hammer found it to be in 1880. Lieut. Schjørring made a triangulation of the environs, setting up marks for future use. The glacier in the Sikuijuitsok fjord has also retired a long distance since 1880. Dr. Engell also surveyed the mountain Akugdlinguak, 1837 feet high, and adjacent heights on the Orpiksuit fjord near Kristianshaab, and examined the inland ice behind them. In the same number of the *Meddelelser om Grønland* (Hefte 22), Dr. Schultz-Lorentzen compares the dialects, customs, implements, etc., of the Eskimo of east and west Greenland, and from the greater similarity between those of the east Greenlanders and the Eskimo of the west coast south of Godthaab, arrives at the conclusion that the latter are the vanguard of a migration down the east coast. The same subject has been discussed by Prof. Faustini (see vol. 23, p. 392), who did not, however, clearly mark the meeting-place of the eastern and western migratory streams.

Results of National Antarctic Exploration: Erratum.—April *Journal*, p. 374, line 27, for "Derville" read "d'Urville."

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Motion of Glaciers.—In a paper entitled "A Contribution to the Theory of Glacial Motion" (University of Chicago: Decennial Publications), Prof. Chamberlin gives a concise summary of his views on the cause of glacial movement. Incidentally, he discusses the method by which snow passes into coarsely granular glacier-ice, the distribution of temperature in glaciers, and the effects of differential movement and shearing. He points out that in a moving glacier there are two apparently discordant phenomena to be explained: the glacier moves like a plastic mass, with a higher velocity at its centre than towards its edges, and adapting itself more or less perfectly to the shape of the channel in which it flows; at the same time it has many properties implying considerable rigidity under thrust, can hold stones embedded in its base so firmly that they groove and tear out solid rock, and can be forced forward by pressure from behind even against a considerable slope. The conclusion arrived at is that even where a glacier is coldest, dryest, and most rigid, the impelling power of its own weight can cause it to move forward by means of small displacements of the component granular ice-crystals on one another. The crystalline gliding-planes are not supposed to be of importance except locally, but movement is facilitated by temporary liquefaction of the glacier grains at their surfaces, where the pressure is greatest, followed by freezing as soon as the pressure is relieved. The explanation favoured is consequently a modification of the "viscous" theory, combined with those of regelation and crystalline deformation.

GENERAL.

Geography in the University of Edinburgh.—A laudable effort is being made in Edinburgh for the endowment of a chair of geography at the university of that city. A step towards the further recognition of geography as a subject of study has been taken by the Senatus of the university, which has decided to admit the subject as one qualifying for graduation in the Faculties of Science and Arts. A proposal for the establishment of a chair in geography has met with official approval, which has also been expressed by the councils of the Royal Scottish Geographical Society, the Royal Society of Edinburgh, and the Edinburgh Merchant Company. As a practical step towards the end in view, a committee has been formed for the purpose of raising the necessary funds, which are estimated at £15,000. The chairman is Dr. James Geikie, and the secretary Mr. J. G. Bartholomew, to whom subscriptions to the fund may be sent.

OBITUARY.

Adolph Bastian.

By the death of Prof. Adolph Bastian at Port of Spain, Trinidad, on February 3, 1905, ethnology loses one of its most illustrious exponents. Throughout the second half of the nineteenth century the name of the "Old Master," as his German colleagues were fond of calling him, has largly dominated this branch of science, to the advancement of which his whole life was earnestly and unselfishly devoted. Son of a prosperous Bremen trader, he was born in that busy seaport on June 26, 1826, and there, perhaps, acquired that restless enterprising spirit which

later carried him to the ends of the Earth in the exclusive interests of the one object which entirely absorbed his prodigious physical and mental energies. After studying law at Heidelberg, and the biological sciences at Berlin, Jena, and Würzburg, he took the degree of M.D. at Prague in 1850, and the very next year set out on that long series of ethnological expeditions, which jointly occupied no less than twenty-five years of a singularly active career, and would justify his claim to be regarded as the greatest of collectors and of travellers, if his modest and retiring nature could have induced him ever to have claimed anything for himself personally. But the remark made by Dr. Karl von den Steinen, one of the speakers at the "Gedächtnisfeier," held in Berlin on March 11, that no German savant has travelled, read, or written more than Bastian, will pass unquestioned by those acquainted with his life-work in all its fulness.

The first journey, which lasted eight years (1851–59), took him to Australia, Peru, the West Indies, Mexico, China, Malaysia, Indo-China, India, Angola, and other parts of West Africa, and the special bent of his mind for the psychological side of his subject was at once revealed in the sub-title ('A Contribution to Mythology and Psychology') of his first publication ('A Visit to San Salvador,' 1859), which embodied some of the fruits of the expedition. The influence of the views here advocated was almost instantaneous, as shown by the rapid appearance of the great works of Th. Waitz and E. B. Tylor on the origin and development of primitive cultures.

Then followed the second expedition (1861–65), which brought him again to Indo-China, and thence through Malaysia and the Philippines to Japan, North China, Siberia, and Caucasia, resulting in 'The Peoples of Eastern Asia,' a work in six volumes indispensable to students of Buddhism. A third trip to Loango (1873), undertaken for the purpose of opening up the Dark Continent from the west side, proved a failure, but prepared the way for the subsequent expeditions, all of which were henceforth carried out in the direct interest of the Berlin Ethnological Museum, of which Bastian was the real founder and for many years curator. The fourth (1875–76), directed to South and Central America (Ecuador, Colombia, Peru, Guatemala, and the West Indies for the second time), supplied the materials for the valuable 'Culture Lands of Ancient America' in two stout volumes (1878). The next three years (1878–80) were given to India, Indo-China, and Malaysia (for the third time), and then to North and East Australia, Fiji, Hawaii, California, and Yucatan, one memorable result of which was 'The Religious Myths of the Polynesians' (1881). Then followed at longer intervals the fifth expedition (1878) through Persia, India, and Assam to New Zealand and Hawaii (where Polynesian texts were collected), and thence to the North-Western United States, Mexico, and Yucatan; the sixth (1889–91) through Russian Turkestan to India and East Africa; the seventh (1896–98) chiefly in Java and Bali; the eighth (1901–03) in Ceylon; the ninth and last (1903–05) to Malaysia, Jamaica (where much exhaustive work was given to the cavemen and kitchen middens), Trinidad, Venezuela, and back to Trinidad, where this unwearied collector and explorer literally "died in harness."

And what are the abiding results of all this *improbus labor*? There are, certainly, the magnificent collections which form the chief glory of the Berlin Museum. There are many tens of thousands of square miles of the Earth's surface rapidly surveyed from the great "periegetes'" special standpoint, but without an eye either for their physical features or even for their peculiar characters as the suitable *milieu* of their human inhabitants, whence the remarks of Von den Steinen and of Von Richthofen (another of the speakers at the commemorative gathering) that Bastian was neither a geographer nor an ethnologist in the strict sense of these

terms. Lastly, there is a whole library of psychological writings, which can scarcely be called ethnological, and in any case are well-nigh unreadable—a hopeless tangle of involved constructions without any attempt at form, style, or system, a literary wilderness that has been compared to the sunless Amazonian woodlands, where guide and guided alike are lost in a maze of endless tracks leading anywhere or nowhere. Hence his warmest admirers are fain to confess that this amazing *incongesta moles* was received, volume after volume, with a sad shake of the head, put aside, and then "nicht mehr gelesen" (von den Steinen).

Nevertheless, Bastian has left at least one precious heirloom which should keep his name for ever fresh in the memory of those who have at heart the best interests of anthropological studies. He, more perhaps than any other writer, has helped to establish the psychic unity of mankind on firm ground. Leaving to others the physical characters, the craniology, the comparative anatomy generally, he devoted his exclusive attention to the comparative psychology, to the mental qualities, to the soul, and that he found everywhere one from the lowest Australian and Polynesian to the highest Hellenic and modern types. A peculiarly practical side of his own complex temperament, which made him a shrewd man of business and a great collector, and not merely a mystic or pantheistic dreamer of dreams, enabled him also to give to his ethno-psychology that solid foundation which seems to be lacking in the purely subjective systems of his great fellow-countrymen—Hegel, Fichte, and even Kant—and brings him more into line with the English objective school, as represented especially by Herbert Spencer, Darwin, and Huxley.

A. H. Keane.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Tenth Meeting, March 27, 1905.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections.—*Henry James Ashton; Webster Brown, C.E.; William Burnett; Rev. Putman Cady, M.A.; Richard Cooke; Robert W. Dana, M.A., M.I.C.E.; Henry Shalford Dawes; Lieut. Henry Dawson, R.N.R.; Robert Lindsay Forbes; John Hyde; P. B. Joshi; James Knott; Rev. Canon Maccoll, M.A., D.D.; Robert St. John Mathews; Captain Charles Otley Place, D.S.O., R.E.; Captain Charles M. Ritchie, R.H.A.; Captain C. P. Roberts, R.G.A.; Edward Stanislaus Benbow Rowe; Eugene Wihlfahrt.*

The Paper read was:—

"Liberia." By Sir Harry H. Johnston, G.C.M.G., K.C.B.

Eleventh Meeting, April 10, 1905.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections.—*Eneas Percy Bates, B.A.; Hugh Blakiston; Lieut. Gordon Hargreaves Brown, C.G.; Richard Raymond Carne; Lieut. Robert Sterling Clark, U.S.A.; Joseph Gibson Collinson; Prof. Archibald Cary Coolidge, Ph.D.; Herbert Ashley Cunard Cummins; Captain Bryan Fairfax, Durham Light Infantry; Gustave Gillman; Campbell Login Harrison; R. Fleming Johnston; Edgar Lawn; George Norton Stevens; Major Hugh Stanley Thurston, R.A.M.C.; Erik Tollefsen; Colonel Edward Tufnell, M.P.*

The Paper read was:—

"The Upper Yangtse Provinces." By Colonel Manifold.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Central Europe. **Partsch.**

Mitteleuropa. Die Länder und Völker von den Westalpen und dem Balkan bis an den Kanal und das Kurische Haff dargestellt von Dr. J. Partsch. Gotha: Justus Perthes, 1904. Size 9 × 6, pp. xii. and 464. *Maps. Price* 10*m. Presented by the Publisher.*

This is the original work, revised and brought up to date, of which the English edition, included in the 'Regions of the World' series, was a somewhat abridged translation. Some additions have been made for the benefit of German readers.

Europe—Rainfall. *Petermanns M.* **50** (1904): 281–285. **Kassner.**

Das regenreichste Gebiet Europas. Von Prof. Dr. K. Kassner. *Map.*

The district alluded to is that round the head of the Bay of Cattaro.

France. **Baedeker.**

Northern France from Belgium and the English Channel to the Loire, excluding Paris and its Environs. Handbook for Travellers by K. Baedeker. Fourth Edition. Leipzig: K. Bædeker; London: Dulau & Co. 1905. Size 6½ × 4½, pp. xxxvi. and 424. *Maps and Plans. Price* 7*m. Presented by the Publishers.*

France—Rhône, etc. *B.S.G. Lyon* **19** (1904): 173–202, 272–315. **Turquan.**

Géographie Agricole, Industrielle, Commerciale et Économique du Département du Rhône et Régions environnants. Par V. Turquan. *With Maps.*

Germany—Black Forest. *Deutsch. Rundschau G.* **27** (1904): 110–115. **Koch.**

Zur Entwicklung der Flösserei im Schwarzwalde. Von L. Koch.

Germany—Bremen. *Deutsch. G. Blätter* **27** (1904): 127–146. **Tetens.**

Ueber Bremens Bedeutung als Handelsplatz. Vortrag von Dr. F. Tetens. *Map and Diagrams.*

Germany—Odenwald. *Forsch. deutsch. Landes- u. Volkskunde* **15** (1904): 237–289. **Jaeger.**

Ueber Oberflächengestaltung im Odenwald. Von Dr. F. Jaeger. *With Map.*

Germany—Saxony. *Z.K. Sächs. Statist. Bureaus* **50** (1904): 161–172. **Wiechel.**

Eine Volksdichte-Schichtenkarte von Sachsen in neuer Entwurfsart. Von H. Wiechel. *With Map.*

Holland—Sea-level. *K. Ned. Meteorolog. I.*, No. 90 (1904): pp. 22. **Van der Stok.**

Etudes des phenomènes de marée sur les Côtes Néerlandaises. 1. Analyse des mouvements périodiques et apériodiques du niveau de la mer. Par J. P. van der Stok.

Iceland. *Oversigt K. Danske Vidensk. S. Forhand.* (1904): 217–267. **Pjetursson.**

Om nogle glaciale og interglaciale Vulkaner paa Island. Af H. Pjetursson.

Iceland—Forests. *G. Tidskrift* **17** (1903–1904): 238–241. **Prytz.**

Lidt om Træveksten paa Island. Af Prof. C. V. Prytz. *Illustrations.*

Cf. note in *Journal* for September, 1904 (p. 346).

Italy. *Ann. G.* **13** (1904): 348–360. **Besnier.**

La Conque de Sulmona. Par M. Besnier. *With Plate.*

This refers to a district in the Abruzzi intercalated between the parallel folds of the Central Appenines. The author sketches the human as well as the physical geography.

Italy—Genoa. **Léotard.**

Une visite à Gênes. Comparaison avec Marseille. Par J. Léotard. (Extrait du *Sémaphore* et du *Bulletin* de la Société.) Marseille, 1904. Size 10 × 6½, pp. 32. *Plans and Illustration. Presented by the Author.*

Italy—Vesuvius. *B.S. Belge Géologie* **18** (1904): (*Proc.-Verb.*) 228–231. **Brun.**

La dernière éruption du Vésuve. Par A. Brun.

Mediterranean. *C.Rd.* **139** (1904): 379–381. **Negris.**

Nouvelles observations sur la dernière transgression de la Méditerranée. Note de P. Negris.

See note in the *Journal* for October, 1904 (p. 483).

North-West Europe—Hydrography. **Krümmel.**

Die Deutschen Meere im Rahmen der internationalen Meeresforschung. Offentlicher Vortrag, gehalten im Institut für Meereskunde am 5. und 6. März 1903. Von Dr. O. Krümmel. (Veröffentl. I. Meereskunde, etc., Heft 6, 1904.) Berlin: E. S. Mittler und Sohn. Size 10½ × 7½, pp. 36. *Maps.*

Pyrenees. *Questions Dipl.* **18** (1904): 529–540. **Lorin.**

Les chemins de fer transpyrénéens. Par Prof. H. Lorin.

Russia. *G.Z.* **10** (1904): 481–596, 537–569, 600–626, 666–691. **Kettner.**

Das europäische Russland. Eine anthropogeographische Studie. Von A. Hettner. *Also separate copy, presented by the Author.*

A careful study of human life and activity in Russia as conditioned by physical geography.

Russia. ———

Bulletin Russe de Statistique, Financière et de Législation. Année 1904. Livraison 1. St.-Pétersbourg, Imp. V. Kirschbaum, 1904. Size 11 × 7, pp. 176.

Russia—Finland. *Deutsch. G. Blätter* **27** (1904): 176–188. **Karstedt.**

Die südfinnische Skärenküste von Wiborg bis Hangö. Von F. O. Karstedt.

Russia—Ural. *Izvestiya Imp. Russ. G.S.* **40** (1904): 161–166. **Savelief.**

Third journey in the Ural. By R. Savelief. [In Russian.]

Russia—Urals. *B. Comité Géolog. St.-Pétersbourg* **22** (1903): 417–436. **Koniuschevsky.**

Compte rendu préliminaire sur les recherches géologiques faites en 1902 dans l'Oural du sud. Par — Koniouschevsky. [In Russian.]

Spain. *C. Rd.* **139** (1904): 894–896. **Douvillé.**

Sur les Préalpes subbétiques au sud du Guadalquivir. Note de R. Douvillé.

Sweden—Anthropogeography. *Ymer* **24** (1904): 314–331. **Andersson.**

Om de fysiskt-geografiska förutsattningarna för bebyggelsen inom några af Jämtlands fjälltrakter. Af G. Andersson. *Map and Illustrations.*

On the physical conditions determining settlement in some mountainous districts of Jämtland.

United Kingdom—Archæology. **Hubbard.**

Neolithic Dew-Ponds and Cattle-Ways. By A. J. Hubbard and G. Hubbard. London: Longmans & Co., 1905. Size 10 × 7, pp. x. and 70. *Illustrations. Price* 3*s.* 6*d. net. Presented by the Publishers.*

Shows reason for believing that some of the dew-ponds and cattle-tracks on the Downs date from Neolithic times.

ASIA.

Asia. **Zichy.**

Dritte Asiatische Forschungsreise des Grafen Eugen Zichy. Band vi. Forschungen im osten zur Aufhellung des Ursprunges der Magyaren. Geschichtliche Uebersicht und meine Wahrnehmungen, Erfahrungen mit besonderer Berücksichtigung der Ergebnisse meiner Expeditionen. Von Graf E. Zichy. Budapest; Leipzig: K. W. Hiersemann, 1905. Size 12½ × 9½, pp. 304. *Maps and Illustrations. Price* 20*s.*

This volume includes an historical sketch of Hungarian expeditions and researches in the past; a sketch of the scientific results of Count Zichy's own journey; and a personal narrative of the same. It is excellently illustrated from photographs.

Caspian Sea. *Petermanns M.* **50** (1904): 291–294. **Knipowitsch.**

Hydrobiologische Untersuchungen des Kaspischen Meeres. Reiseberichte von N. Knipowitsch.

China—Population. **Rockhill.**

Inquiry into the Population of China. By W. W. Rockhill. (From *Smithsonian Misc. Coll.* (*Quarterly Issue*), vol. 47, part 3.) Washington, 1904. Size 10 × 6½, pp. 303–321. *Presented by the Author.*

Noticed in the Monthly Record for March (p. 327).

Chinese Empire—Tibet. **Landon.**

Lhasa: an Account of the Country and People of Central Tibet, and of the Progress of the Mission sent there by the English Government in the year 1903–4. Written, with the help of all the principal persons of the mission, by Perceval Landon. 2 vols. London: Hurst and Blackett, 1905. Size 10 × 7, pp. (vol. 1) xx. and 414; (vol. 2) xii. and 426. *Maps and Illustrations. Price* 42*s. net. Presented by the Publishers.* [Reviewed in the present number, p. 551.]

Chinese Empire—Tibet. **Millington.**

To Lhassa at Last. By P. Millington. Second Edition. London: Smith, Elder & Co., 1905. Size 8 × 5½, pp. x. and 200. *Frontispiece. Price* 3*s.* 6*d. net. Presented by the Publishers.* [See p. 553, *ante.*]

Eastern Asia. ———

Handbook of Information for Shippers and Passengers by the Steamers of the Nippon Yusen Kaisha (Japan Mail S.S. Co., Ltd.). 1904. Size 9 × 6, pp. iv. and 348. *Maps and Illustrations.*

French Indo-China. **Doumer.**

Paul Doumer. L'Indo-Chine française (Souvenirs). Paris: Vuibert et Nony, 1905. Size 12½ × 8½, pp. xvi. and 392. *Maps and Illustrations. Price* 8*s.* 6*d.*

Presents M. Doumer's personal impressions and experiences during his tenure of the governor-generalship of Indo-China, with appreciations of the present position and prospects of that region.

French Indo-China—Laos. *B. Comité l'Asie Française* **4** (1904): 523–532. **Danchaud.**

Le climat de France sous les tropiques: le plateau du Tran-ninh. Par le Capitaine Danchaud. *Maps.*

India. *Tour du Monde* **10** (1904): 157–216, 373–408. **Boeck.**

Mes Voyages aux Indes et au Népal. Par le Docteur K. Boeck. Adapté de l'allemand par F. Ricard. *Map and Illustrations.*

India. **Bradley-Birt.**

The Story of an Indian Upland. By F. B. Bradley-Birt. And an Introduction by the Hon. H. H. Risley. London: Smith, Elder & Co., 1905. Size 9½ × 6, pp. xii. and 354. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

This book supplies the general reader for the first time with a history and description of the "Santal Perganas" inhabited by some of the most interesting of the aboriginal tribes of Central India, of which no satisfactory general account had previously been in existence.

India—Census. ———

Census of India, 1901, vols. i., i.-A. Part i. Report. Part ii. Tables. By H. H. Risley and E. A. Gait. Calcutta: 1903. Size 13½ × 8½, pp. (vol i.) 582; (vol. i.-A 492. *Price* (vol. i.) 7*s.* 6*d.*; (vol. i.-A) 6*s.*

Ditto, Ethnographic Appendices. By H. H. Risley. Calcutta: 1903. Pp. 251. *Maps. Price* 4*s.* 6*d.*

Noticed in the February number (p. 197).

India—Population. *J.R. Statistical S.* **67** (1904): 661–670. **Baines.**

The Geographical Distribution of Population in India. By J. A. Baines, C.S.I. *With Diagram. Also separate copy.*

Japan—Magnetic Survey. **Tanakadate.**

J. College Sci., Imp. University Tōkyō **14** (1904): pp. xii., 180, and 348.

A Magnetic Survey of Japan reduced to the Epoch 1895.0 and the Sea Level, carried out by order of the Earthquake Investigation Committee. Reported by Prof. A. Tanakadate. *With Maps and Plates.*

Japan—Sea-level. **Omori.**

Note on the Annual Variation of the Height of Sea-level at Ayukawa and Misaki. By F. Omori. (Publications Earthquake Investigation Committee in Foreign Languages, No. 18, pp. 23–26.) Tōkyō, 1904. Size 10½ × 7½. *Diagram.*

Korea. *B.S.G. Rochefort* **26** (1904): 216–225. **Pawlowski.**

Historique de la connaissance de la Corée d'après la cartographie. Par A. Pawlowski.

Korea. *Nouv. Archiv. Miss. Sci.* **12** (1904): 131–141. **Bourdaret.**

Rapport sur une Mission Scientifique en Corée. Par É. Bourdaret.

The writer, who went out to Korea to study the question of railways, occupied his spare time in anthropological and natural history research. The greater part of the paper deals with anthropology.

Korea. **Ducrocq.**

Georges Ducrocq. Pauvre et Douce Corée. Quatrième Édition. Paris: H. Champion, 1904. Size 7½ × 5½, pp. 88. *Illustrations. Presented by the Publisher.*

Malay Archipelago—Tides. *Ann. Hydrographie* **32** (1904): 363–371. **Meyer.**

Die Gezeiten im Ostindischen Archipel. Von H. Meyer.

Malay Archipelago—Timor. **Grijzen.**

Verh. Batav. Genoots. Kunsten en Wetens. **54** (3) (1904): pp. 146.

Mededeelingen omtrent Beloe of Midden-Timor. Door H. J. Grijzen.

Manchuria. *Mem. Imp. Russ. G.S. (Gen. G.)* **35** (1904): pp. 566. **Anert.**

Journey through Manchuria [Expeditions of 1896 and 1897–98]. E. E. Anert. [In Russian.] *With Maps and Illustrations.*

This important work will be reviewed elsewhere.

Russia—Siberia. *Petermanns M.* **50** (1904): 285–290. **Breitfuss.**

Zur Frage über den Sibirischen Seeweg nach Osten. Von Dr. L. Breitfuss. *With Map.*

AFRICA.

East Africa—Masai. **Hollis.**

The Masai, their Language and Folklore. By A. C. Hollis. With Introduction by Sir Charles Eliot. Oxford: Clarendon Press, 1905. Size 9 × 6, pp. xxviii. and 360. *Map and Illustrations. Price* 14*s. net. Two copies, presented by the Publishers.*

Eritrea. *B.S.G. Italiana* **5** (1904): 782–786. **Marini.**

Il rilievo topografico della Colonia Eritrea. Nota del Prof. A. Marini. *With Map.*

Fernando Po. *J. Manchester G.S.* **20** (1904): 29–36. **Nunan.**

Fernando Po, West Africa. By T. J. Nunan.

The writer has resided in the island.

French Guinea. *B.S.G. Italiana* **5** (1904): 786–795. **Joûbert.**

Le Isole di Loos, e Conacri (Africa occidentale). Nota del J. Joûbert. *With Map.*

French Guinea—Frontier. **Meyreuil.**

Renscign. Col. Com. Afrique Franç. (1904): 253–257.

La Mission Maclaud. La Delimitation de la Frontière entre la Guinée Française, la Casamance et la Guinée Portugaise. Par A. Meyreuil. *With Map.*

German South-West Africa. *T. Geolog. S. South Africa* **7** (1904): 77–94. **Voit.**

A Contribution to the Geology of German South-West Africa. By F. W. Voit. *Map with Sections.*

Gold Coast. **Crowther.**

The Gold Coast Civil Service List (1904–5). Compiled by F. Crowther. London: E. Stanford, 1904. Size 10 × 6½, pp. 442. *Map. Price* 6*s. Presented by the Publisher.*

A valuable publication, giving much useful information on public works, frontier delimitation, official regulations, etc., etc.

Kamerun. *Deutsch. Kolonialzeitung* **22** (1905): 70–72. **Moisel.**

Die Expedition Stieber in das Musgugebeit und die Wasserstrasse Garua-Tschad. Von M. Moisel. *With Map.*

Captain Stieber, who examined the country on the left bank of the Lagone near the Tuburi lake, does not share Captain Lenfant's sanguine anticipations as to the possibilities of this route to Lake Chad (see *ante*, p. 567).

Kamerun. *Globus* **86** (1904): 273–278, 337–344. **Lessner.**

Die Baluë- oder Rumpiberge und ihre Bewohner. Von Oberleutnant Lessner. *With Illustrations.*

Madagascar—Railway. *Rev. Madagascar* **6** (1904): 509–559. ———

Inauguration du chemin de fer de Tananarive à la Mer. *Maps.*

Morocco. *Renseign. Col. Com. Afrique Franç.* (1904): 221–243, 258–274. **Bernard.**

Une Mission au Maroc. Rapport à M. le Gouverneur Général de l'Algérie. Par A. Bernard. *With Map.*

Nigeria. **Bedwell.**

Southern Nigeria. Report for 1903. Colonial Reports, Annual No. 433, 1904. Size 9½ × 6, pp. 48. *Price* 3*s.*

Nile. **Willcocks.**

The Nile in 1904. By Sir W. Willcocks, K.C.M.G. London: E. & F. N. Spon, 1904. Size 10½ × 7½, pp. 226. *Maps and Sections. Price* 9*s. net. Presented by the Author.* [To be reviewed.]

Uganda. **Cunningham**

Uganda and its Peoples. Notes on the Protectorate of Uganda, especially the Anthropology and Ethnology of its Indigenous Races. By J. F. Cunningham. With a Preface by Sir Harry Johnston, G.C.M.G. London: Hutchinson & Co., 1905. Size 10 × 7½, pp. xxx. and 370. *Map and Illustrations. Price* 24*s. net. Presented by the Publishers.* [To be reviewed.]

NORTH AMERICA.

Canada—Selkirk Range. *Appalachia* **10** (1904): 404–408. **Wheeler.**

Notes on the Altitude of Mts. Columbia, Bryce, Lyell, and Forbes. By A. O. Wheeler.

See note in the March number, p. 328.

Mexico. *Mem. y Rev. S. Ci. "Antonio Alzate"* **18** (1902): 83–112. **Ordoñez.**

Le Xinantecatl ou Volcan Nevado de Toluca. Par E. Ordoñez. *With Plates.*

Mexico. **Ordoñez and Prado y Tapia.**

Mem. y Rev. S. Ci. "Antonio Alzate" **18** (1902): 257–265.

Los Volcanes de Zacapu, Michoacan. Por E. Ordoñez y F. Prado y Tapia. *With Map.*

Mexico. ———

Mexico. Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled by the International Bureau of the American Republics. 1904. Washington, 1904. Size 9½ × 6, pp. 454. *Illustrations. Presented by the International Bureau of the American Republics.*

North America. *B. Geolog. S. America* **14** (1903): 207–226. **Spencer.**

Submarine Valleys off the American Coast and in the North Atlantic. By J. W. Spencer. *With Maps.*

North America—Early Travels. **Thwaites.**

New Voyages to North America by the Baron de Lahontan. Reprinted from the English edition of 1703, with facsimiles of original title-pages, maps, and illustrations, and the addition of Introduction, Notes, and Index, by R. G. Thwaites, LL.D. 2 vols. Chicago: A. C. McClurg & Co., 1905. Size 8½ × 6, pp. xciv. and 798. *Price* $7.50.

United States. *J.G.* **3** (1904): 243–310. **Brigham and others.**

The Geography of the Louisiana Purchase. *With Maps and Illustrations.*

Includes a number of articles by different writers, the first, by Prof. Brigham, treating of the geographical importance of the Louisiana purchase.

United States. *Symons's Meteorolog. Mag.* **39** (1904): 181–185. **Mill.**

The Vengeance of the Rain Gods. By the Editor.

Describes a visit to the Grand canyon and a Navaho village, with a subsequent unwonted deluge, no doubt attributed by the Indians to the carrying away of their rain-gods by an American man of science.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Bernárdez.**

The Land of Promise for Labour and Small Capital. The Argentine Estancia. A review of the Live-Stock and Agricultural industries, and of the rural prospects of the Argentine Republic. By M. Bernárdez. Buenos Aires, 1903. Size 10½ × 7½, pp. viii. and 124. *Maps and Illustrations.*

Argentine Republic. **Martinez.**

Manual del Viajero. Baedeker de la República Argentina. Par A. B. Martinez. 2ª Edición. Buenos Aires, 1904. Size 7½ × 5, pp. xvi. and 384. *Maps, Plans, and Illustrations.*

Argentine and Uruguay. ———

St Louis Exhibition. Argentine Republic. Ministry of Public Works. Direction-General of Hydraulic Works. Project for improving the Navigability of the River Plate and Concordia. Explanatory Index of the Objects exhibited. Buenos Aires, 1904. Size 10½ × 7, pp. 82.

Bolivia. ———

Bolivia. Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled by the International Bureau of the American Republics, 1904. Washington, 1904. Size 9½ × 6, pp. 214. *Illustrations. Presented by the International Bureau of the American Republics.*

Bolivia—Trade. *B. Oficina Nac. Inmigración La Paz* **4** (1904): pp. 326. ———

Resumen estadistico del comercio exterior de Bolivia correspondiente al año de 1903.

Brazil. *Globus* **86** (1904): 346–349. ———

Dr. Herrmann Meyers deutsche Ackerbau-Kolonien in Südbrasilien. *With Illustrations.*

Chile—Earthquakes. **Goll.**

Die Erdbeben Chiles. Ein Verzeichnis der Erdbeben und Vulkanausbrüche in Chile bis zum Ende des Jahres 1879 nebst einigen allgemeinen Bemerkungen zu diesen Erdbeben. Von Dr. F. Goll. (Münchener geographische Studien, herausgegeben von S. Günther. Vierzehntes Stück.) München: T. Ackermann, 1904. Size 9 × 6, pp. vi. and 138. *Diagram.*

Dutch Guiana. **Stockum.**

Tijdsch. K. Ned. Aardrijk. Genoot. **21** (1904): 88–122, 227–310, 651–721, 822–878, 1022–1069.

Verslag van de Saramacca-Expeditie. Door A. J. Van Stockum. *Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Sturt's Expedition. **Blacket.**

P.R.G.S. Australasia: S. Australian Br. **7** (1904): 66–69.

An Interesting Discovery. By the Rev. J. Blacket.

On the recent discovery of a part of Captain Sturt's MS. *Journal* (see *ante*, p. 331).

Caroline Islands. *M. Deutsch. Schutzgeb.* **17** (1904): 192–197. **Senfft.**

Bericht über den Besuch einiger Inselgruppen der West-Karolinen. Von — Senfft.

Caroline Islands—Uleai. *M. Deutsch. Schutzgeb.* **17** (1904): 175–191. **Born.**

Einige Beobachtungen ethnographischer Natur über die Oleaï-Inseln. Von Dr. Born.

New Guinea. *J. Manchester G.S.* **20** (1904): 8–28. **McFarlane.**
My Experiences as a Pioneer Missionary amongst the Cannibals of New Guinea. By Rev. S. McFarlane, LL.D. *Illustrations.*

New Guinea. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **22** (1905): 360–371. **Ijzerman.**
De Nieuw-Guinea-Expeditie van het Koninklijk Nederlandsch Aardrijkskundig Genootschap. Door J. W. Ijzerman.

Various reports from members of this expedition (cf. *ante*, p. 97) are here printed, bringing the chronicle of events down to December last.

Pacific. *M. Deutsch. Schutzgeb.* **17** (1904): 208–216. **Moisel.**
Begleitworte zu der Karte "Neue Aufnahmen aus der Südsee." Von M. Moisel. *With Map.*

POLAR REGIONS.

Antarctic—Climate. *Ymer* **24** (1904): 297–313. **Bodman.**
Om Klimatet i Antarktis med särskild hänsyn till Graham Land. Af G. Bodman. *Sketch-map and Illustrations.*

Greenland. *Meddelelser om Grønland* **26** (1904): 1–70. **Engell.**
Undersøgelser og Opmaalinger ved Jakobshavns Isfjord og i orpigsuit i sommeren 1902. Af M. C. Engell. *Maps and Illustrations.*

Greenland. *Meddelelser om Grønland* **26** (1904): 407–434. **Krogh.**
The Abnormal CO_2 Percentage in the Air in Greenland, and the General Relations between Atmospheric and Oceanic Carbonic Acid. By A. Krogh.

Greenland. *Meddelelser om Grønland* **26** (1904): 71–89. **Schjørring.**
Trekantnettet langs Jakobshavns Isbræ og dets Bestemmelse. Af H. Schjørring. *Diagram.*

On a trigonometrical survey of the Jakobshavn glacier.

Greenland—Eskimo Immigration. **Schultz-Lorentzen.**
Meddelelser om Grønland **26** (1904): 289–330.
Eskimoernes Indvandring i Grønland. Af Schultz-Lorentzen.

MATHEMATICAL GEOGRAPHY.

Astronomy.
Appendix to Nautical Almanac, 1905. Corrections to the Apparent Places of Nautical Almanac Stars visible at Greenwich. Size 9½ × 6½, pp. 22.

Cartography. *National G. Mag.* **15** (1904): 405–408. **Penck.**
Recent Progress in the Execution of a Map of the World on the Uniform Scale of 1 : 1,000,000. By Dr. A. Penck.

Cartography—Korean Map. *B. American G.S.* **36** (1904): 600–605. **Hulbert.**
An Ancient Map of the World. By H. B. Hulbert. *Illustrations.*

On the Korean map referred to in Mr. Collyer's paper (*Journal*, vol. 23, p. 486).

Cartography—Projection. *Petermanns M.* **50** (1904): 277–281. **Hammer.**
Zwei praktische Beispiele schiefachsiger zylindrischer Kartennetzentwürfe. Von Prof. Dr. E. Hammer. *With Plate.*

Longitude Determination. *C. Rd.* **139** (1904): 1010–1015. **Lœwy.**
Détermination faite en 1902 de la différence de longitude entre les méridiens de Greenwich et de Paris. Note de M. Lœwy.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Launay.**
La Science Géologique, ses méthodes, ses résultats, ses problèmes, son histoire. Par L. de Launay. Paris: A. Colin, 1905. Size 10 × 6½, pp. 750. *Maps and Illustrations. Price 20 fr. Presented by the Publisher.*

Meteorology.
Kaiserliche Marine, Deutsche Seewarte. Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. I. Band. Eingänge des Jahres 1903. Berlin: E. S. Mittler und Sohn, 1904. Size 10½ × 7½, pp. viii. and 184. *Price 3m. Presented by the Publishers.*

Oceanography. **Ruppin.**

Zweiter Beitrag zur Bestimmung und Verwertung des Gasgehaltes des Meerwassers. Von Dr. E. Ruppin. (Separatabdruck aus: Wissenschaftliche Meeresuntersuchungen. Abt. Kiel. N. F. Band 8.) Kiel, 1904. Size 13½ × 10½, pp. 127–134. *Diagram. Presented.*

Oceanography—Bathymetric Map. **Thoulet.**

B. Musée Océanograph. Monaco, No. **21** (1904): pp. 28.

Carte bathymétrique générale de l'Océan. Par J. Thoulet. *Map.*

Physical Geography. *J. Geology* **12** (1904): 524–550. **Russell.**

Physiographic Problems of To-day. By I. C. Russell.

Ripple-Marks. *Naturw. Wochenschrift* **3** (1904): 1025–1031. **Geinitz.**

Bilder von Windwirkungen am Strande. Von F. E. Geinitz. *With Illustrations.*

Rivers. *B. American G.S.* **36** (1904): 589–599. **Tower.**

The Development of Cut-off Meanders. By W. S. Tower. *With Illustrations.*

Surface Features. *Smithsonian Contrib. Knowledge* **34**, No. 1438 (1903): pp. 80. **Shaler.**

A Comparison of the Features of the Earth and the Moon. By Prof. N. S. Shaler. *Plates.*

Zoogeography. *G. Tidskrift* **17** (1903–1904): 229–238. **Wesenberg-Lund.**

Om en nulevende i vore Søer indelukket marin arktisk Istidsfauna. Af Dr. C. Wesenberg-Lund.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *J.G.* **3** (1904): 409–412. **Whitbeck.**

Response to Surroundings—A Geographic Principle. By R. H. Whitbeck.

Exploration. *National G. Mag.* **15** (1904): 392–404. **Chester.**

Some Early Geographers of the United States. By Rear-Admiral C. M. Chester.

Historical—Alfred the Great. **Geidel.**

Alfred der Grosse als Geograph. Von Dr. H. Geidel. (Münchener geographische Studien, herausgegeben von S. Günther. Fünfzehntes Stück.) München: T. Ackermann, 1904. Size 9 × 6, pp. 106.

Historical—Columbus. **Vignaud.**

Études critiques sur la vie de Colomb avant ses découvertes. . . . Par H. Vignaud. Paris: H. Welter, 1905. Size 9 × 6½, pp. xvi. and 544. *Price* 10 *fr. Presented by the Publisher.*

Historical—Portuguese Conquests. **Emanuel.**

Epistola Potentissimi ac inuictissimi Emanuelis Regis Portugaliæ et Algarbiorum. etc. De Victoriis habitis in India and Malacha. Ad. S. in Christo Patrem et Dñm nostrum Dñm Leonem X. Pont. Maximum. Romæ, 1513. [Facsimile.] Size 8½ × 6, pp. [12].

Historical—Pytheas. **Eitel.**

P.R.G.S. Australasia: S. Australian Br. **7** (1904): 30–47.

The First Polar Expedition, 325 B.C. By Rev. Dr. Eitel.

BIOGRAPHY.

Brard. *B.S.G. Marseille* **28** (1904): 129–134. **Hamy.**

Jean-Nicholas Brard, peintre-naturaliste provençal, explorateur des Antilles (1748–1822). Notice biographique par le Dr. E.-T. Hamy.

Kuropatkin. *B.S.G. Lyon* **19** (1904): 316–319. ———

Le Général Kouropatkine explorateur et géographe.

Stanford. *Publishers' Circular* **81** (1904): 581. **Marston.**

Edward Stanford. A Personal Reminiscence. By E. Marston. *Portrait.*

GENERAL.

International Congress. *National G. Mag.* **15** (1904): 387–392. **Peary.**
Address by Commander Robert E. Peary on the Assembling of the Eighth International Geographic Congress in Washington.

Petermanns Mitteilungen. *Petermanns M.* **50** (1904): 275–277. **Supan.**
Zum Abschluss des 50 Bandes von Petermanns Mitteilungen. Von Prof. Dr. A. Supan.

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Brecknockshire, XX. 11. **Cardiganshire,** III. 4, 6, 8, 12, 13, 14, 15; IV. 13, 14; VI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16; VII. 8, 9, 10, 12, 13, 14, 15, 16; VIII. 9; (IX. 4 and X. 1); IX. 8, 12; (X. 1 and IX. 4); X. 2, 3, 4, 5, 6, 7, 8, 9, 10,

11, 12; XI. 1, 2, 3, 4, 5, 6, 8, 10, 11, 12; XII. 5, 9, 10. **Devonshire**, IVA. 6; XXXI. 8; LV. 3, 4, 6, 8, 12, 14, 16; LVI. 14, 15, 16; LXVII. 2, 3, 4, 6, 7, 8, 10, 11, 12; LXVIII. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12; LXIX. 1, 5, 9; LXXXII. 9; XCIII. 15, 16; (CIII. 4 and CIIIA. 1). **Herefordshire**, XIII. 6; XIV. 11; XXI. 4, 12, 16; XXII. 1, 5; XXVIII. 4; XXIX. 1, 2, 6, 10, 14; XXXVI. 2, 3, 6, 7, (10 and 11), 14; XLII. 2, 6. **Lincolnshire**, CIII. 4, 8, 12; CIV. 5, 9, 10, 14, 16; CV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CVI. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXVI. 16; CXVII. 6, 8, 12. **Norfolk**, XCI. 5, 6, 8, 10, 11, 12, 16; XCII. 10, 14; XCIII. 7, 8, 9, 10, 11, 13; XCIV. 6, 7, 8, 9, 10, 12, 14, 15, 16; XCV. 1, 2, 3, 4, 5, 7, 9, 10, 11, 12, 13, 14, 15, 16; XCVI. 10, 13, 14; CII. 8; CIII. 2, 3, 4; CIV. 7, 8, 12; CV. 13; CVI. 13; CX. 2. **Radnorshire**, XIV. 2, 6, 10. **Somerset**, VI. 7. **Suffolk**, V. 16; VI. 14; VII. 9, 10, 13; XXV. 2; XXVIII. 11. **Warwickshire**, XXII. 2, 15; XXVI. 10; XXVIII. 1, 4, 5, 7, 8, 9, 11, 12; XXIX. 1, 5, 9; XXXI. 6, 10, 11; XLIII. 9, 10. **Worcestershire**, XXVI. 2, 5; XXXII. 2, 3, 6, 9, 10, 14, 15; XXXIX. 2, 3, 16; XLVI. 4, 8, 12, 16; LIII. 4. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 7, 11, 12. *3s. each.*

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England and Wales. **Geological Survey.**

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(*E. Stanford, London Agent.*)

Iceland. **Thoroddsen.**

Die Bruchlinien Islands von Th. Thoroddsen. Scale 1 : 2,300,000 or 36·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 6. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Macedonia. **Reimer.**

Karte der christlichen Schulen in Macedonien. Nebst erläuterndem Text "Die christlichen Schulen in Macedonien." Scale 1 : 400,000 or 6·3 stat. miles to an inch. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Price 6m.*

An outline map of Macedonia, showing by coloured symbols, Greek, Bulgarian, Rumanian, and Servian schools, Greek churches and monasteries, and other information and statistics of a kindred nature. This map is accompanied by twelve pages of letterpress.

Russian Empire. **Koverski.**

Map of the Russian Empire and Neighbouring Countries. By Lieut.-General E. Koverski. Scale 1 : 8,400,000 or 132·6 stat. miles to an inch. 4 sheets. St. Petersburg: Ministry of Ways and Communications, 1904. [In Russian.]

This map includes, not only the Russian Empire, but the greater part of Europe, and the whole of Northern and Central Asia. It gives travellers' routes, railways, principal roads, telegraphs, steamer lines, besides information concerning the physical characteristics of the country. There is no hill work; but even without this, owing to the numerous lines of one kind and another, the map has a somewhat confused appearance in some parts. However, much information can be obtained from it by a careful and close inspection. Copious notes are given at the side and bottom of the map, but these are, of course, in Russian.

Switzerland. **Kummerly.**

Carte Générale de la Suisse. Par H. Kummerly. Scale 1 : 400,000 or 6·3 stat. miles to an inch. With Index. Bern: H. Kummerly & Frey and A. Francke, [1904].

A well-drawn general map of Switzerland and parts of the adjacent countries, artistically printed in colours. The relief is shown by shading and oblique illumination, and on the whole the effect is graphic and good; but in some instances, as is often the case with this style, unless it is combined with contours, the proper relation between the slopes is hardly indicated, the darker slopes appearing steeper than they really are owing to the deeper shade. However, the general result is most satisfactory, and the map is well brought up to date, as is evidenced, amongst other things, by the Simplon tunnel being shown.

Switzerland. **Machaček.**

Kartenskizze der Flussentwicklung im Berner Jura. Von Dr. F. Machaček. Scale 1 : 200,000 or 3·1 stat. miles to an inch.—Geologische Profile aus dem Berner Jura. Von Dr. F. Machaček. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 150, Tafeln 1 u. 2. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

ASIA.

Asia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1 : 1,168,031 or 18·4 stat. miles to an inch. Sheets (new editions): XIV., Urga; XXII., Lanchau. St. Petersburg: Military Topographical Department, 1903. [In Russian.]

China. **Stanford.**

A large-scale map of the Peking Syndicate Railway, showing the density of population along the route. Scale 1 : 411,840 or 6·5 stat. miles to an inch. London: Edward Stanford, 1905.

Manchuria. **Topographical Section, General Staff.**

Map of the Country North of T'ieh-ling, to illustrate the Campaign in Manchuria (provisional issue without hills). Scale 1 : 420,000 or 6·7 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price* 2*s. Presented by the Director of Military Operations.*

This map is a continuation northwards of that showing the country round Mukden, and includes Kirin. It is enlarged from the Russian Staff Map on the scale of 1 : 840,000, with additions from the 1 : 1,680,000 map of the same department.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Lagos, 73-C, 73-D, 73-G; Northern Nigeria, 74-A, 74-B, 74-C, 74-D; Southern Nigeria, 73-H, 73-L, 73-P, 74-E, 74-F, 74-G. London: Topographical Section, General Staff, War Office, 1905. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Egypt. **Topographical Section, General Staff.**

Map of Egypt. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price* 4*s.* 6*d. Presented by the Director of Military Operations.*

Eritrea. **Instituto Geografico Militare, Florence.**

Carta della Colonia Eritrea. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 14, Gruta; 21, Zula; 21 *bis*, Harčna; 28, Buia; 28 *bis*, Samoti; 34, Endĕli. Florence: Instituto Geografico Militare. *Price* 1.5 *lire each sheet.*

German South-West Africa. **Woerner.**

Karte des Geländes zwischen Rehoboth und Gibeon sowie der Heliographenlinie Windhuk-Gibeon, konstruiert und gezeichnet von Oberleutnant Woerner. Scale 1 : 200,000 or 4·2 stat. miles to an inch.—Karte der Heliographenlinie Karibib-Outjo sowie der Wege zwischen Etiro und Outjo, konstruiert und gezeichnet von Oberleutnant Woerner. Scale 1 : 200,000 or 4·2 stat. miles to an inch. *Mitteilungen aus den deutschen Schutzgebieten*, Band xvi., Karten 3 u. 4. Berlin: E. S. Mittler u. Sohn, 1903.

These are good specimens of route traverses. All survey points and heliograph stations are marked, and the lines connecting the latter are indicated by a broken black line. Many useful notes appear on the map concerning the character of the country, water-supply, animal life, etc. The relief is shown by horizontal form lines in brown. No latitudes or longitudes are given on the maps.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: LIV., Sidi Ali Ben Aoun; LVI., El Aguareb. Paris: Service Géographique de l'Armée, [1905]. *Price* 1.20 *fr. each sheet.*

Zambezi River. **Stanford.**

River Zambezi from Zumbo to the Victoria Falls. Scale 1 : 250,000 or 3·9 stat.

miles to an inch. 3 sheets. London: Edward Stanford. *Presented by the British South Africa Company.*

The river is shown in blue, with names and notes concerning breadth, navigability, rapids, etc., from Major Gibbons, in black. The map is evidently only provisional, and the river is shown as about the same breadth throughout the whole of the course, no narrowing in at the gorges and rapids being indicated. In some respects it differs from the survey made by Major Gibbons from September to December, 1890. No soundings are given, and no information as to the average depth of water at different seasons.

AMERICA.

Canada. **Surveyor-General of Canada.**

Sectional Map of Canada. Scale 1: 190,080 or 3 stat. miles to an inch. Battleford Sheet (62), West of Third Meridian, revised to September 28, 1904; Ribston Creek Sheet (70), West of Fourth Meridian, revised to October 17, 1904; Rocky Mountain House Sheet (85), West of Fifth Meridian, revised to October 17, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

GENERAL.

World. **Johnston.**

Johnstons' Commercial and Library Chart of the World on Mercator's Projection, from the latest and best authorities, containing the position of every place of commercial importance, showing the principal Ocean Currents and the Chief Steamship Routes. 4 sheets. Edinburgh and London: W. & A. K. Johnston, [1905]. *Price, mounted on rollers and varnished, £3 3s. Presented by the Publisher.*

Johnstons' Commercial and Library Chart of the World is well known, having already passed through several editions. It has been again revised and brought up to date. All important corrections appear to have been made, and the map, or chart as the publishers choose to call it, will doubtless be of great service in offices and commercial establishments. It can be obtained in four sheets, or mounted on rollers and varnished.

World. **Johnston.**

The Royal Atlas of Modern Geography exhibiting, in a series of entirely original and authentic maps, the present condition of Geographical Discovery and Research in the several Countries, Empires, and States of the World. By the late Alexander Keith Johnston, with additions and corrections to the present date by G. H. Johnston. New Edition. Edinburgh and London: W. & A. K. Johnston, 1905. *Price £6 6s. Presented by the Publishers.*

Although the title-page and preface of this edition bear the date 1905, and in the latter it is stated that the atlas has been "brought thoroughly up to date," it is in many respects considerably behind the times.

It is true that in the lower left-hand corner of the maps different dates appear, in small figures, contradicting the title-page and preface, but these are almost certain to be overlooked, and naturally it will be supposed that the atlas has been brought up to the present year as stated. In the map of the North Polar Regions (frontispiece), there is no indication of the important discoveries and explorations of Captain O. Sverdrup to the north-west of Jones sound, and the same serious omission is noticeable on the map of North America. On map No. 40, Africa, the boundary between Northern Nigeria and French Sudan is wrongly laid down. Maps 54 and 55 both show Panama as still forming part of the Republic of Colombia, while on the latter the new boundary between the northern part of Bolivia and Brazil, according to the treaty of 1903, is not shown. These are defects that strike the eye at a glance, but other instances might be quoted, all tending to show that the atlas needs most thoroughly revising. For example, on the map of Switzerland, there is no indication of the Simplon tunnel, or of the railway extension to its entrances. On many of the maps, such as Asia and Northern India, the representation of the mountain systems and general relief is very imperfect, doubtless owing partly to the fact that the plates are much worn, having been subjected to many corrections and alterations. Notwithstanding all the interest that has lately been shown in the Antarctic Regions, and the fresh discoveries that have resulted from the numerous recent expeditions, there is no South Polar map. It is clear that if this atlas is to maintain the leading position it has held in the past in the geographical world, it must be thoroughly overhauled, and where necessary, new maps added. It would also be well, in a future edition, to add a few physical maps.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie. Commencé par M. Vivien de St. Martin et continué par F. Schrader. Sheet 46. Asie Mineure et Caucasie. Scale 1 : 5,000,000 or 79·9 stat. miles to an inch. Paris: Hachette et Cie. *Price* 2 *fr. Presented by the Publishers.*

This sheet forms part of a general map of Asia in ten sheets, of which two others have been previously issued. It includes Asia Minor, the Caucasus, Syria, Armenia, and Persia as far north as Ispahan. A list of authorities is given on a separate sheet, and this is fairly exhaustive up to the date of compilation, although a considerable amount of fresh cartographical material has recently been obtained, which will necessitate considerable revision in another edition of the sheet.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich, herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha, 43 und 44 Lieferung. Gotha: Justus Perthes, 1905. *Price* 60 *pfg. each part.*

These parts contain plates: No. 55, general map of Asia, on the scale of 1 : 30,000,000, by H. Habenicht; Nos. 69 and 70, map of Africa, on the scale of 1 : 7,500,000, sheet 1, West Sahara, by B. Domann; sheet 2, East Sahara, by C. Barich; No. 94, general map of South America, on the scale of 1 : 25,000,000, by H. Habenicht.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January and February, 1905. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
2076 m	= 4·2	Scotland, north coast:—Loch Eriboll. 2*s.* 6*d.*
3466 m	= 2·9	Germany. Jade river:—Wilhelmshaven. 1*s.* 6*d.*
180 m	= 7·2	Sicily:—Taormina road. 1*s.* 6*d.*
3473 m	= 1·8	West Indies. Cuba, south coast:—Santa Cruz del Sur and approaches. 2*s.* 6*d.*
146 m	= 3·0	Africa, west coast:—Niger river (Nun entrance). 1*s.* 6*d.*
3478 m	= 2·9	Africa, west coast. Niger river mouth:—Brass river. 1*s.* 6*d.*
3476 m	= 1·5	Bay of Bengal:—Naaf river. 1*s.* 6*d.*
3475 m	= {2·4 / 3·0}	Philippine islands. Luzon, south-east coast:—Matnog bay and Tiklin strait. Port Gubat. 1*s.* 6*d.*
1764 m	= 15·0	China, east coast:—Amoy, inner harbour. 2*s.* 6*d.*
994 m	= {2·0 / 4·0}	Japan. Nipon, south coast:—Yeboshi bana to Anori zaki, including Gokasho ko and Hamashima ko, Hasama ura. 2*s.* 6*d.*
3472 m	= 4·5	Japan, inland sea:—Ujino ko. 1*s.* 6*d.*
2401		Sea of Marmara. Plan added:—Beikos Umur and Buyukdéré bays.
2074		Mediterranean sea. Cyprus. New plan:—Kyrenia.
435		West Indies. Cuba. New plan:—Port Escondido.
2772		Eastern Archipelago. Anchorages in Gillolo. Plan added:—Loloda bay.
1394		China sea. New plan:—Entrance to Kuantan river.
2467		New Guinea. Plans and anchorages on the north coast. New plans:—Jamna road. Anus anchorage.
1510		Pacific ocean. Sandwich islands. Plan added:—Hanapepe bay.

(*J. D. Potter, Agent.*)

Charts Cancelled

No		Cancelled by	No.
2076	Loch Eriboll.	New plan. Loch Eriboll	2076
180	Taormina bay.	New plan. Taormina road	180
1198	Beikos Umur and Buyukdéré bays. Plan on this chart.	Same plan added to	2401

No.		Cancelled by	No.
146	Mouths of the Kwara or Niger river. Brass river.	New plan. Niger river (Nun entrance)	146
		New plan. Brass river	3478
1764	Amoy, inner harbour.	New plan. Amoy, inner harbour	1764
994	Mura and Goza harbours.	New plan. Yeboshi bana to Anori zaki	994
1510	Honolulu harbour. Plan on this chart.		

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

Index charts. A to V (omitting R). No. 1686, England, west coast:—Padstow bay. 2704, Ireland, west coast:—Blacksod bay. 1773, Ireland:—Queenstown and port of Cork. 2251, Baltic sea. Sheet II.:—Kalmar sound, etc. 2728, Spain, north coast:—Bidassoa river to Cape Peñas. 1053, Spain, north-west coast:—Cape Peñas to Pontevedra bay. 689, Spain:—Gibraltar harbour. 366, Cape Verde islands. 565, Iceland, western portion. 321, North America:—Lake Superior. 1148, West Indies, Leeward islands:—Ponce harbour. 2463, Alaska:—Port McArthur to Windham bay. 2462, Alaska:—Windham bay to Icy cape. 2461, Madagascar:—Nosi Vao to Purdy sand. 2871, Madagascar:—Nosi Bé, southern anchorages. 492, India, west coast:—Aguada to St. George islands. 821, Bay of Bengal:—Elephant point to Chedúba strait. 823, Bay of Bengal:—Koronge island to White point. 824, Bay of Bengal:—White point to Mergui. 933, Eastern archipelago:—Batavia roads. 2578, Philippines:—Eastern part of the Sulu sea. 1262, China, south coast:—Hongkong to gulf of Liau-tung. 1199, China, east coast:—Kue shan islands to the Yang-tse Kiang. 1602, China, east coast:—Approaches to the Yangtse Kiang. 1236, China, north coast:—Approaches to Port Arthur, etc. 2412, Japan:—Amoy to Nagasaki. 358, Japan:—The western coasts of Kiusiu and Nipon. 3254, Australia, north coast:—Norman river entrance. 2747, Australia, south coast:—Entrance to Port Phillip, etc. 1069, Australia, east coast:—Port Jackson. 1022, Pacific ocean, islands and anchorages in.

(*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart, No. 99, Tierra del Fuego—Puertos en la parte occidental del canal Beagle. Valparaiso: Oficina Hidrografica, Marine de Chile, 1904. *Presented by the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for April, 1905. London: Meteorological Office, 1905. *Price* 6*d. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic for March and April, 1905. Washington: United States Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for April, 1905. Washington: United States Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

Russian Charts. **Chief Hydrographic Dept., St. Petersburg.**

No.	*Arctic Ocean.*
650	Plan of Indigskaya bay and Indiga river. Scale 1·3 stat. mile to an inch. 1904.
651	Chart of the north-west coast of Liamchina bay (Vaigach Island). Scale 1000 feet to an inch. 1904.
	Black Sea.
620	Chart of the north-east coast of the Black sea, from Psezuape river to Sukhum Kale. Scale 2·3 stat. miles to an inch. 1904.
647	Plan of roadstead at Mezumta river. Scale 2800 feet to an inch. 1904.

North Pacific Ocean.

No.
284 Plans of anchorages on the west side of Saghalin island. 1905.
Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

World. **U.S. Hydrographic Office.**

Chart of the World on Mercator's Projection, showing submarine cables and connections, and also tracks for full-powered steam vessels. Washington: U.S. Hydrographic Office. Supplement to the *National Geographic Magazine* for February, 1905.

This chart appears as a supplement to the *National Geographic Magazine* for February last. It is a new edition of that noticed in the *Geographical Journal* for August, 1902. The tracks of full-powered steam vessels, with the distances, are shown in blue, and the telegraph cables in red. Tables of distances between ports are also given.

PHOTOGRAPHS.

Cullinan Diamond. **Melvill.**

Twelve photographs of the Cullinan Diamond, 3024¾ carats weight, the largest in the world, and of a smaller diamond weighing 334 carats found in the Premier mine, Transvaal, taken by E. H. V. Melvill, Esq. *Presented by E. H. V. Melvill, Esq.*

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Zweite Reihe, Heft 8. Vegetationstypen aus der Kolonie Eritrea. Von Prof. Dr. G. Schweinfurth. Der Text nach den Aufzeichnungen G. Schweinfurth's bearbeitet von Dr. Ludwig Diels. Jena: Gustav Fischer, 1905.

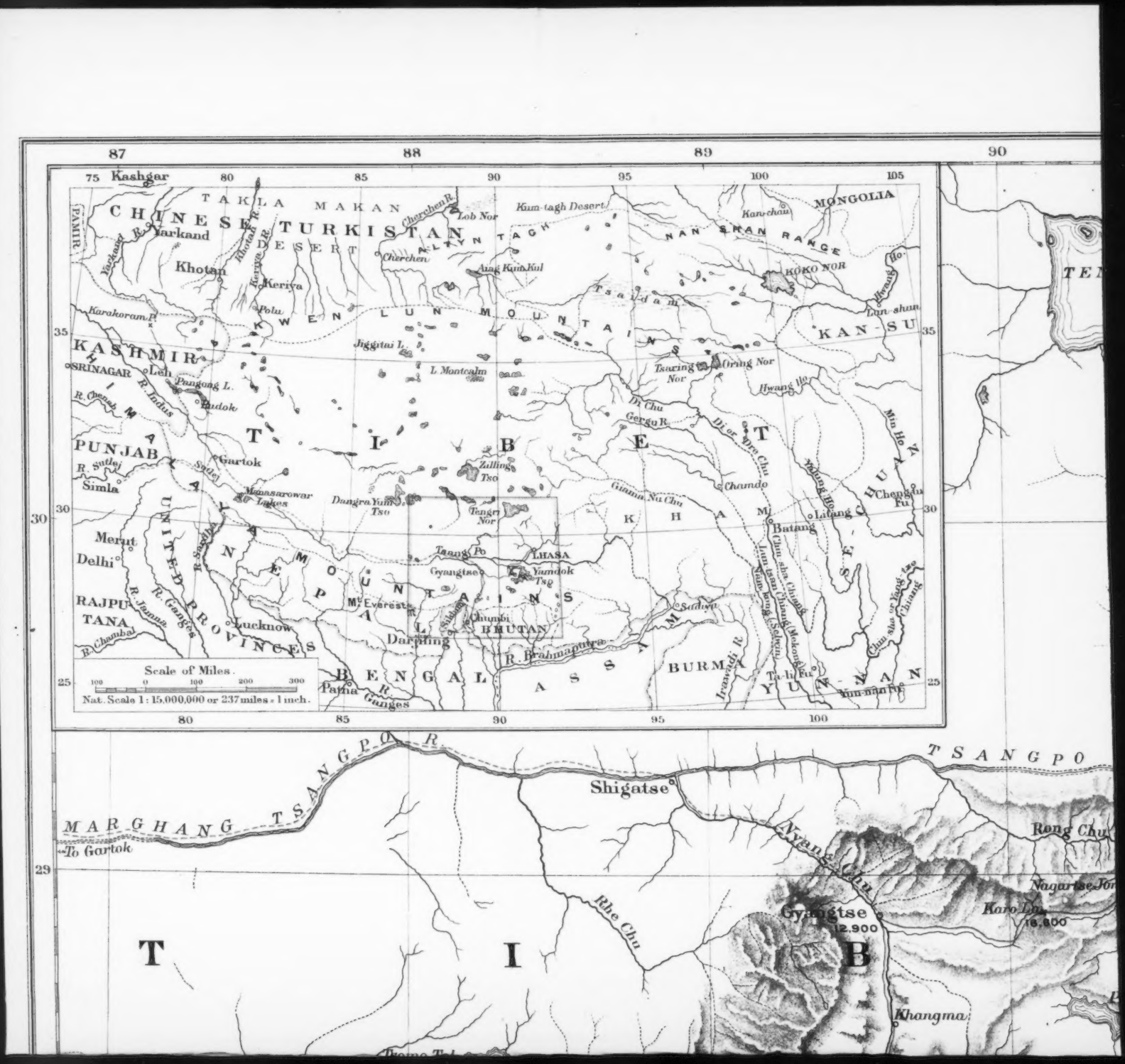
West Africa. **Smith.**

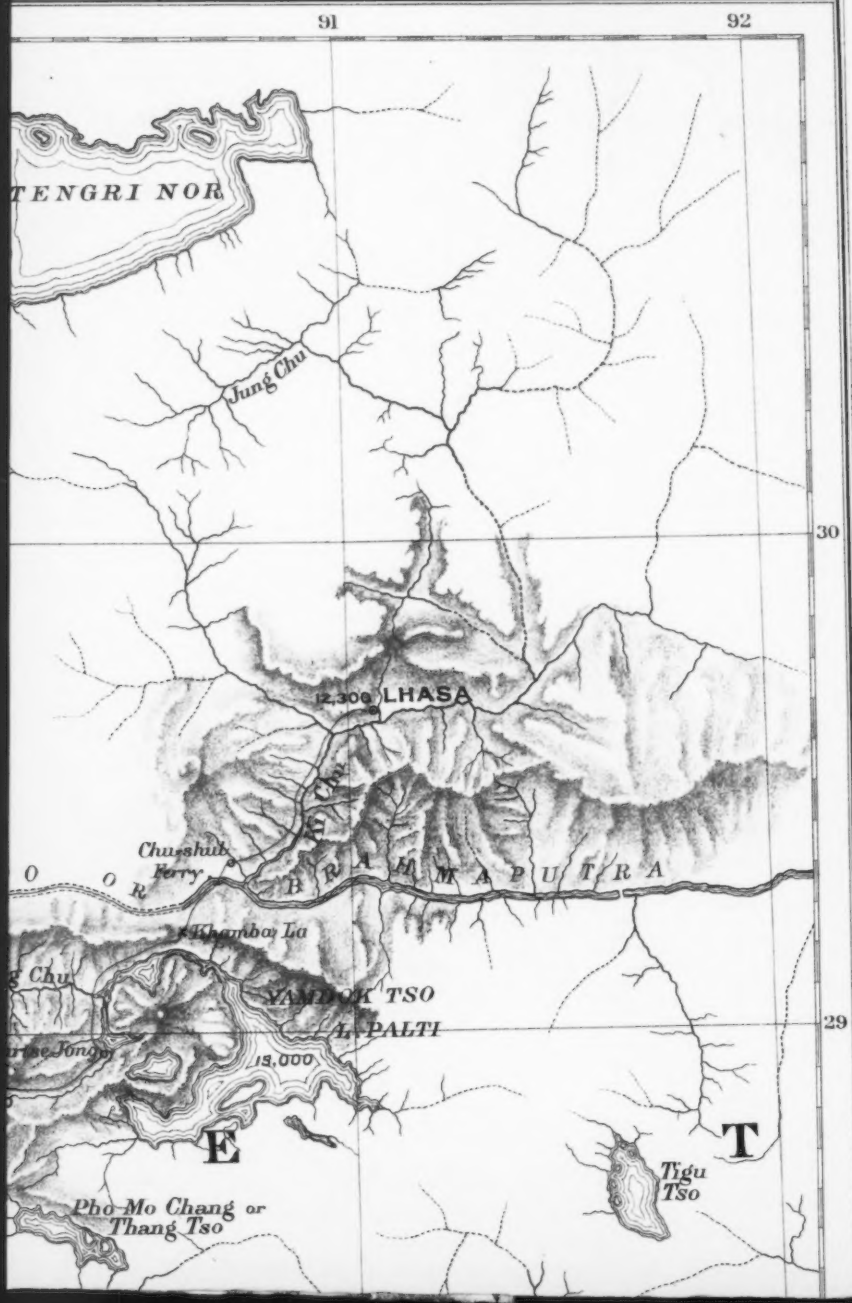
Fifty-four photographs of Sierra Leone and French Guinea, taken by Canon F. C. Smith, M.A. *Presented by Canon F. C. Smith, M.A.*

Canon Smith has had special opportunity for photographing in the interior of Sierra Leone and adjacent regions. The photographs of natives and dances of the "Bundu," or devil women, are specially interesting.

Sierra Leone:—(1) Freetown; (2) The railway station, Freetown; (3) Main street, Freetown; (4) The lighthouse, Freetown; (5) The cathedral, Freetown; (6) Freetown, showing St. George's cathedral; (7) Typical street scene, Freetown; (8) The hills behind Freetown; (9) The Atlantic breaking on the shore near Freetown; (10) Looking from the sea into Freetown harbour; (11) A view at Kent; (12 and 13) The hills of Kent; (14) The Sulima river at Bandajuma; (15) A chief at Bandajuma; (16) Palms, Great Skarcies river; (17) A young cotton tree; (18) A typical village; (19) A hedge of cactus, Banana islands; (20 and 21) "Bundu," or devil women; (22) Devil women dancing; (23 and 24) Mano; (25) Group of children, Mano; (26) The river at Mano; (27) Typical village scene, Mano; (28 and 29) A typical sailing canoe; (30) Some of Mrs. F. C. Smith's admirers; (31) Being carried by hammock in the bush; (32) Mrs. F. C. Smith and a Mendi chieftess; (33) Typical village showing framework of house; (34) Landing-place, Banana islands; (35) Crossing a river; (36) Madam Yoko, a celebrated native queen; (37) The retinue of Madam Yoko; (38) A woman making thread; (39) Mrs. F. C. Smith and the queen of the district; (40) Avenue in Bishop's court. French Guinea:—(41) Kapparroo; (42) Konakry; (43) Constructing the new railway station at Konakry; (44–46) The Rio Pongo; (47) Sunrise at the mouth of the Rio Pongo; (48 and 49) A hunting party; (50 and 51) Dubreka; (52 and 53) Isles de Los; (54) A tornado, Isles de Los.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


87
88
89
90
75 Kashgar
80
85
90
95
100
105
TAKLA MAKAN
CHINESE TURKISTAN
DESERT
Yarkand R.
Yarkand
Khotan
Kiria R.
Keriya
Polu
Karakoram P.
KUEN LUN MOUNTAINS
Cherchen R.
Lob Nor
Kum-tagh Desert
ALTYN TAGH
Cherchen
Ang Kum Kul
Kan-chau
MONGOLIA
NAN SHAN RANGE
KOKO NOR
Ho
Tsaidam
Hwang Ho
Lun-shun
KAN-SU
35
KASHMIR
SRINAGAR
Leh
Pangong L.
Jiggitai L.
L. Montcalm
Tsaring Nor
Oring Nor
Hwang Ho
R. Indus
Rudok
R. Chenab
Di Chu
Gergu R.
Di er pre Chu
Min Ho
HIMALAYA
TIBET
PUNJAB
R. Sutlej
Gartok
Sutlej
Zilling Tso
Simla
Manasarowar Lakes
Dangra Yum Tso
Tangri Nor
Gimmu Nu Chu
Chamdo
Yalung Ho
Chengtu Fu
30
KHAMBA
Batang
Litang
Merut
Delhi
Tsang Po
LHASA
Gyangtse
Yamdok Tso
Jum tsam Chiang
Chiu sha Chiang
Nam kong Selenu (Mekong R.)
Chiu she or Yang tze Kiang
UNITED PROVINCES
R. Jumna
R. Ganges
R. Sardha
NEPAL
MOUNTAINS
Mt. Everest
Sikkim
Chumbi
BHUTAN
RAJPUTANA
Lucknow
Darjiling
Sadiya
R. Brahmaputra
R. Chambal
BENGAL
ASSAM
BURMA
Irawadi R.
Ta-li Fu
YUNNAN
Yun-nan Fu
25
Scale of Miles.
100 0 100 200 300
Nat. Scale 1: 15,000,000 or 237 miles = 1 inch.
80
85
90
95
100
MARGHANG TSANGPO R.
TSANGPO
Shigatse
To Gartok
Ryang Chu
Rong Chu
29
Rhe Chu
Gyangtse
12,900
Nagartse Jong
Karo La
16,600
TIBET
Khangma


91
92
TENGRI NOR
Jung Chu
30
12,300 LHASA
Chushul
Ferry
BRAHMAPUTRA
Thambar La
YAMDOK TSO
PALTI
29
13,000
E
T
Tigu
Tso
Pho-Mo Chang or
Thang Tso

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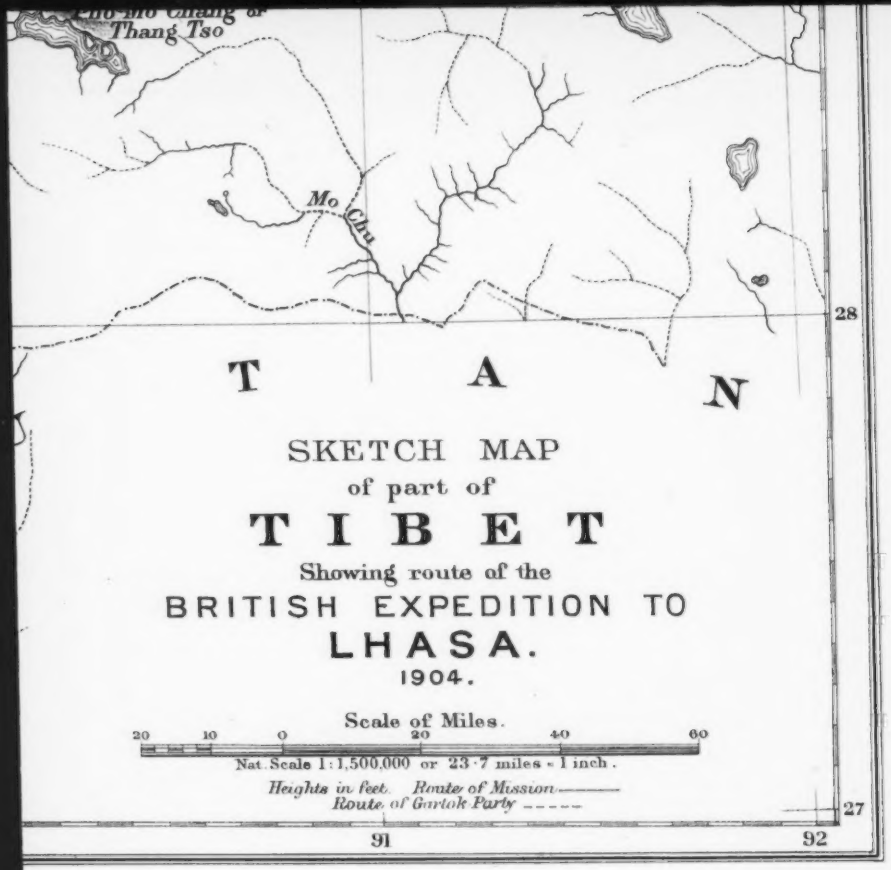
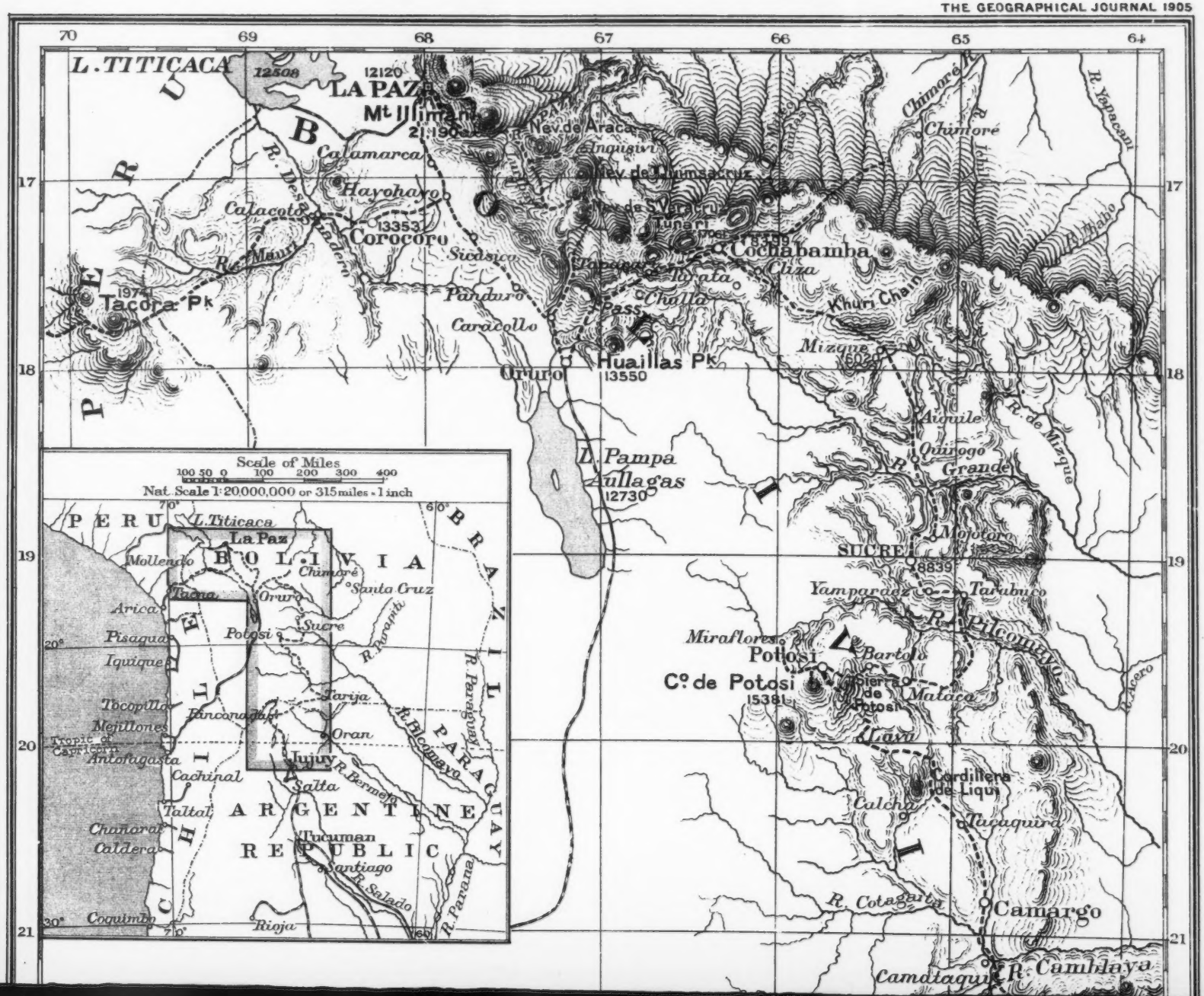
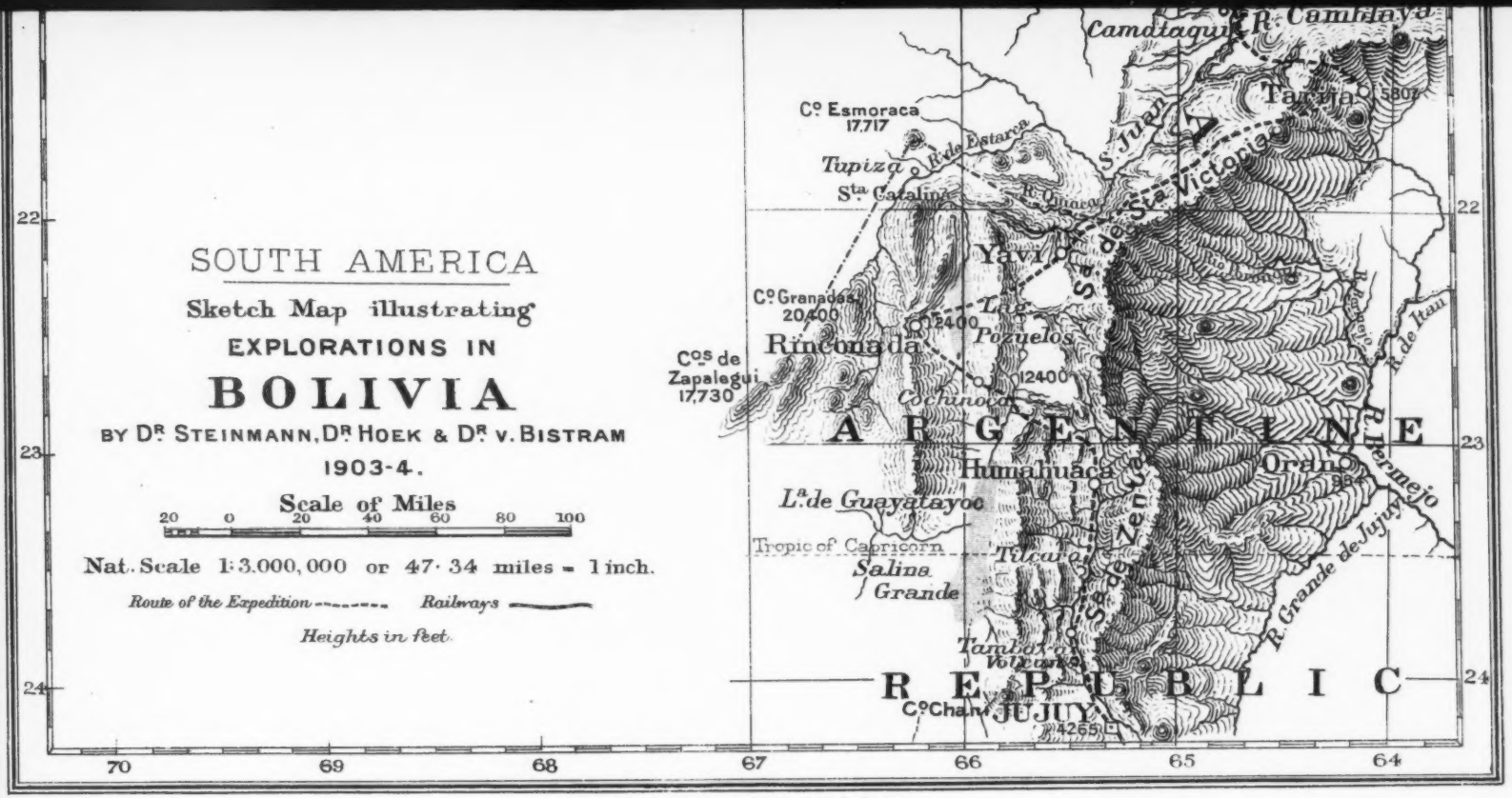

Thang Tso
Mo Chu
28
T A N
SKETCH MAP
of part of
TIBET
Showing route of the
BRITISH EXPEDITION TO
LHASA.
1904.
Scale of Miles.
20 10 0 20 40 60
Nat. Scale 1 : 1,500,000 or 23·7 miles = 1 inch.
Heights in feet. Route of Mission
Route of Gurtok Party
27
91
92

EXPLORATIONS IN
BOLIVIA.
HOEK.





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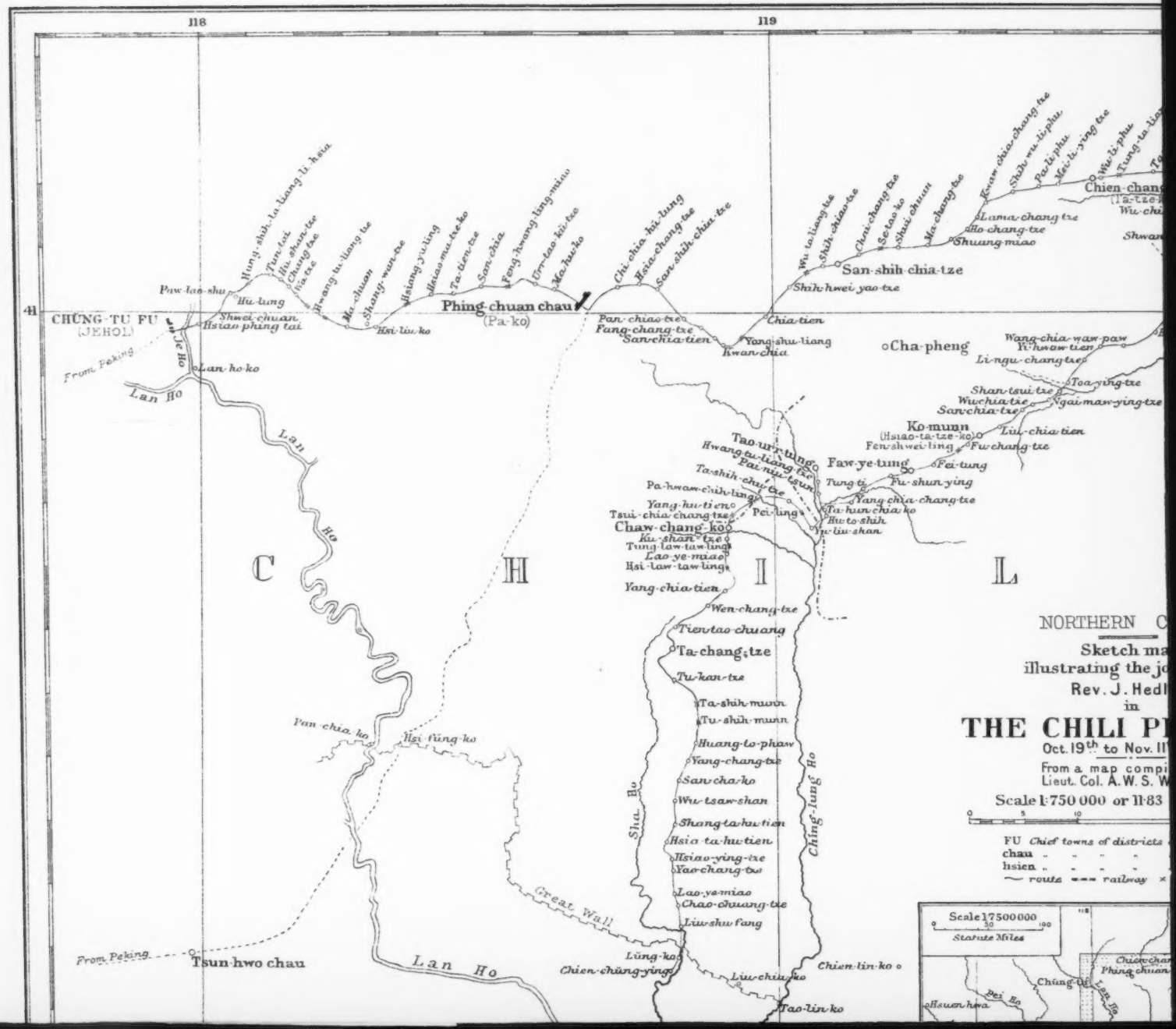
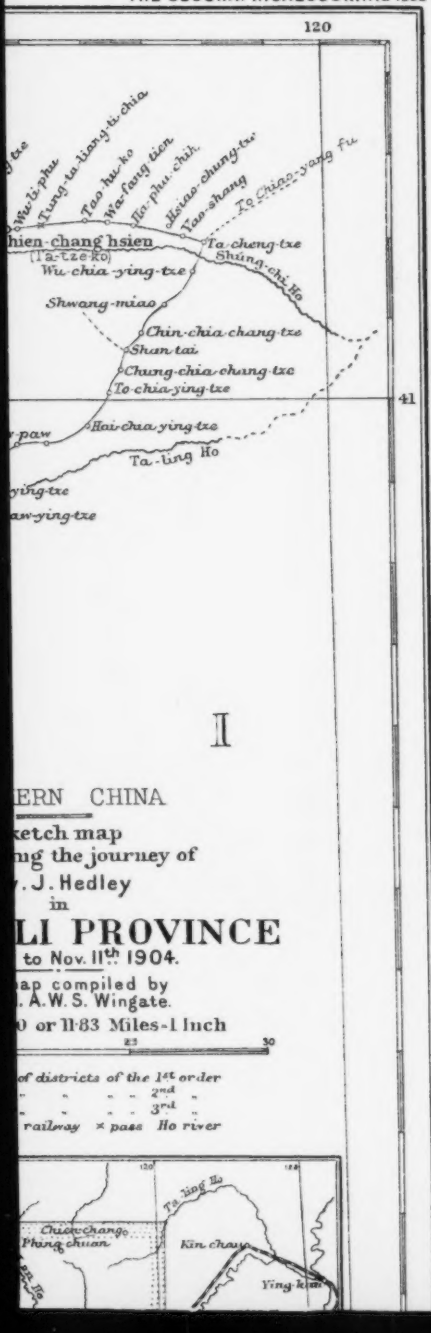
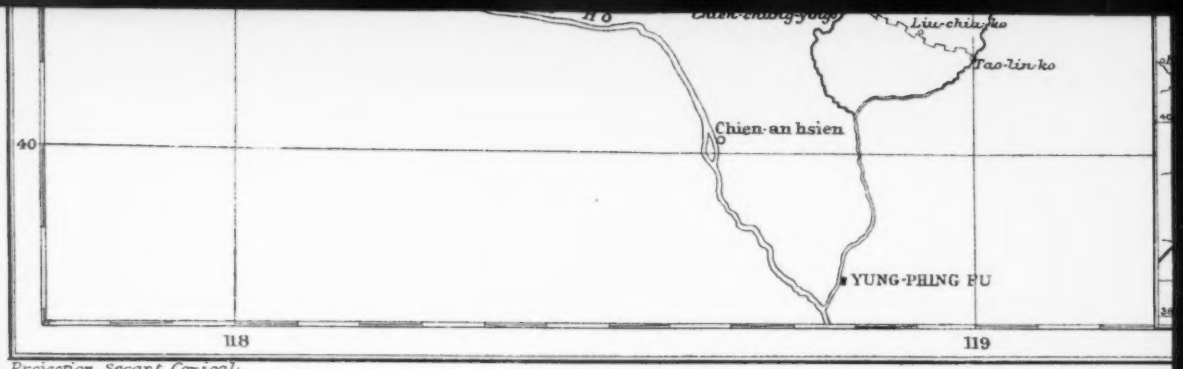

118
119
CHUNG-TU FU
(JEHOL)
Phing-chuan chau
(Pa-ko)
San-shih chia-tze
Cha-pheng
Ko-muun
(Hsiao-ta-tze-ko)
Faw-ye-tung
Chaw-chang-ko
Tsun-hwo chau
Lan Ho
Shwei-chuan
Hsiao phing tai
Lan-ho-ko
Hu-lung
Paw-lao-shu
Hsi-liu-ko
Pan-chiao-tze
Fang-chang-tze
San-chia-tien
Yang-shu-liang
Kwan-chia
Shih-hwei yao-tze
Chia-tien
Li-ngu-chang-tze
Toa-ying-tze
Liu-chia-tien
Fei-tung
Fu-shun-ying
Yang-chia-chang-tze
Ta-hun-chia-ko
Hu-to-shih
Hu-liu-shan
Pei-ling
Tao-li-tung
Ta-shih-chai-tze
Pa-hwan-chih-ting
Yang-hu-tien
Tsui-chia-chang-tze
Ku-shan-tze
Tung-law-taw-ling
Lao-ye-miao
Hsi-law-taw-ling
Yang-chia-tien
Wen-chang-tze
Tien-tao-chuang
Ta-chang-tze
Tu-kan-tze
Ta-shih-muun
Tu-shih-muun
Huang-to-phaw
Yang-chang-tze
San-cha-ko
Wu-tsaw-shan
Shang-ta-hu-tien
Hsia-ta-hu-tien
Hsiao-ying-tze
Yao-chang-tze
Lao-ye-miao
Chao-chuang-tze
Liu-shu-fang
Lung-ko
Chien-chung-ying
Liu-chiu-ko
Chien-lin-ko
Tao-lin-ko
Pan-chia-ko
Hsi-fung-ko
Great Wall
From Peking
Shu Ho
Ching-lung Ho
C H I L
NORTHERN C
Sketch ma
illustrating the jo
Rev. J. Hedl
in
THE CHILI P
Oct. 19th to Nov. 11
From a map compi
Lieut. Col. A.W.S. W
Scale 1:750 000 or 11·83
FU Chief towns of districts
chau
hsien
route
railway
Scale 1:7500000
Statute Miles
Chien-chang
Phing-chuan
Chung-Tu
Lan Ho
Hsuen-hwa
Pei Ho


120
Tung-ta-liang-tz-chia
Tao-hu-ko
Wa-fang-tien
Ha-phu-chik
Hsiao-chung-tsi
Yao-shang
To-Chiao-yang-fu
hien-chang hsien
(Ta-tze-ko)
Ta-cheng-tze
Shung-chi-Ho
Wu-chia-ying-tze
Shwang-miao
Chin-chia-chang-tze
Shan-tai
Chung-chia-chung-tze
To-chia-ying-tze
41
Hai-cha-ying-tze
Ta-ling Ho
II
ERN CHINA
ketch map
ng the journey of
. J. Hedley
in
LI PROVINCE
to Nov. 11th 1904.
ap compiled by
. A.W.S. Wingate.
0 or 11·83 Miles-1 Inch
23
30
of districts of the 1st order
" " " 2nd "
" " " 3rd "
railway × pass Ho river
120
Ta-ling Ho
Chiaochang
Phang chuan
Kin chang
Ying kiang



Projection Secant Conical.

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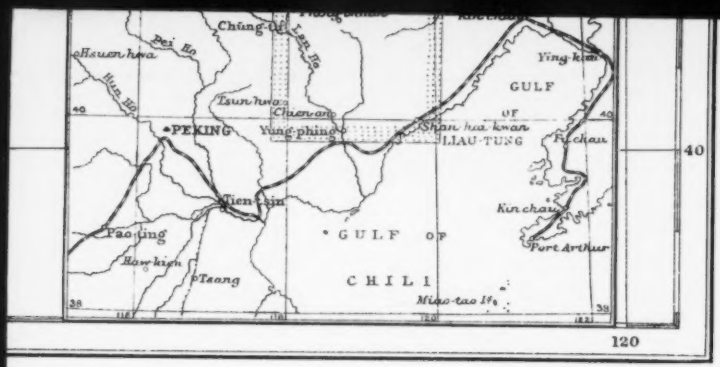
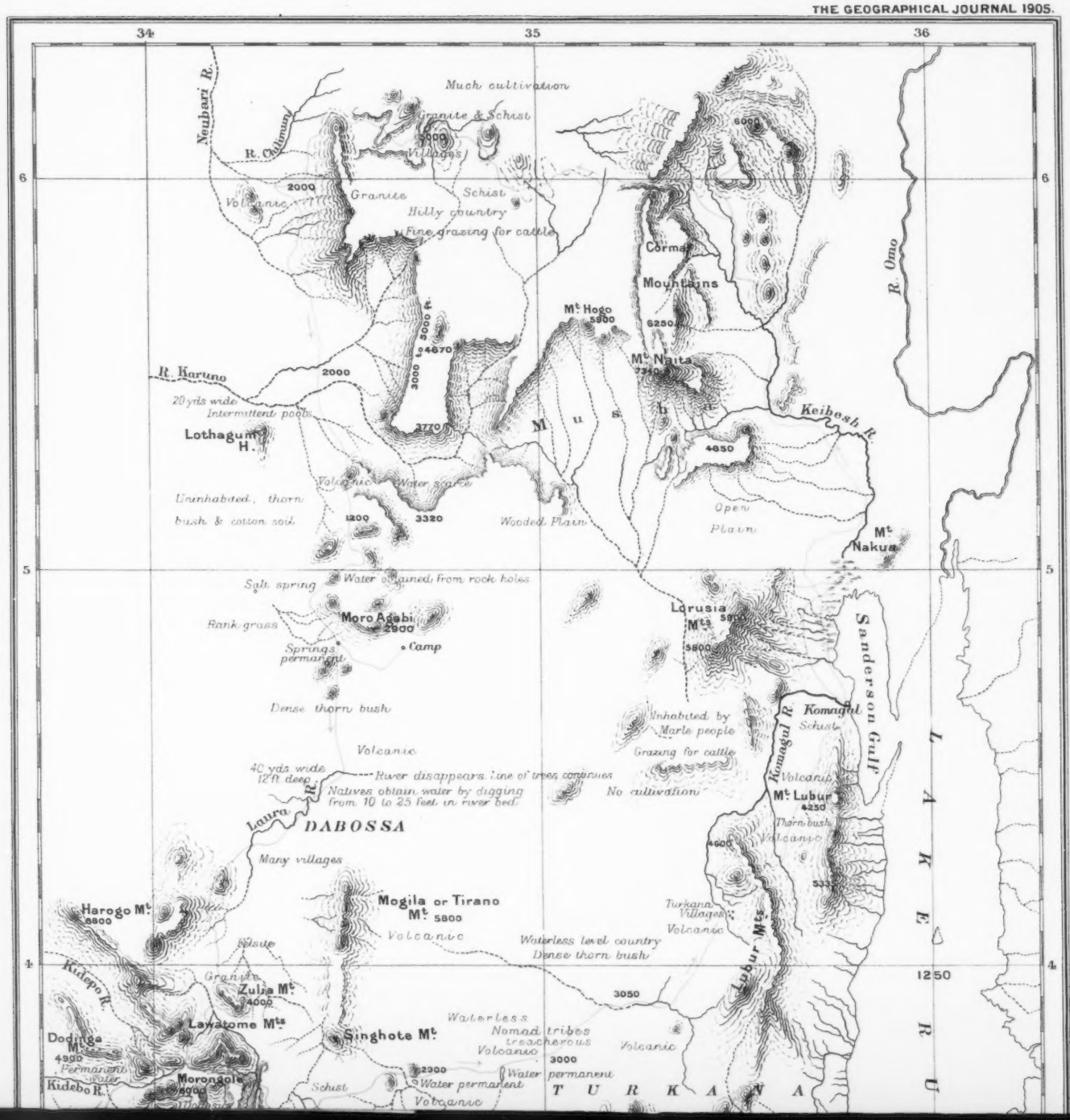
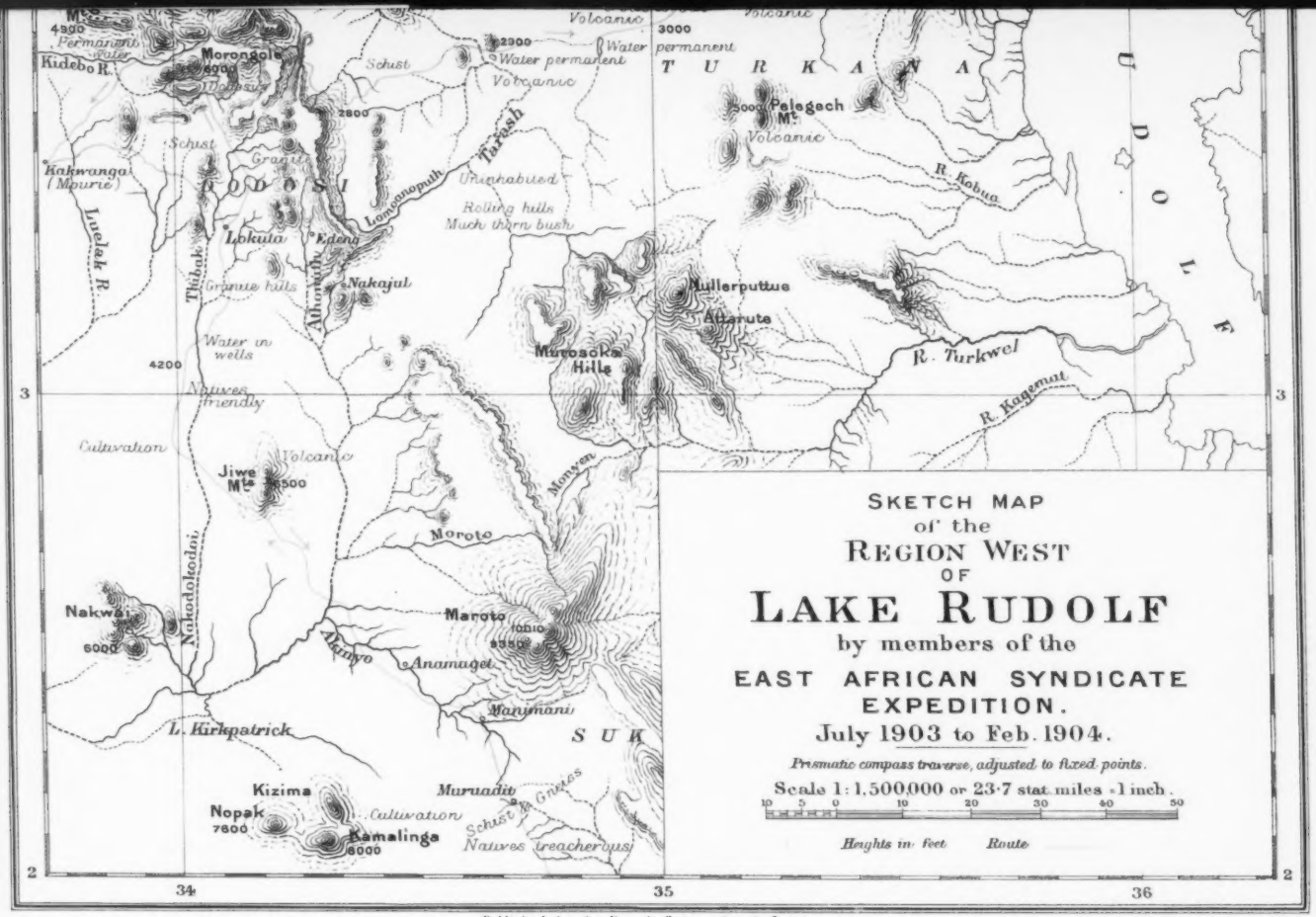

Chung-Ki
Hsuen hwa
Pei Ho
Hun Ho
Tsun hwa
Chen-ting
PEKING
Yung-ping
Shan hai kwan
LIAU-TUNG
GULF
OF
Ying-kow
Fu-chau
Kin-chau
Port Arthur
Tien-tsin
Pao-ting
Haw-kien
Taang
GULF OF
CHILI
Miao-tao Ie
40
39
120

LAKE RUDOLF.
EAST AFRICAN SYNDICATE EXPEDTN





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